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Purchasing and Supply Chain Management: Fostering Innovation

PROCEEDINGS

UNIVERSITY OF PIRAEUS

Audencia BUSINESS SCHOOL

ΧΑΡΟΚΟΠΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ HAROKOPIO UNIVERSITY

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

ΕΙΠ

IPSERA 2018 Conference

Purchasing and Supply Management
Fostering Innovation

CONFERENCE PROCEEDINGS

Foreword

The 27th Annual IPSERA (International Purchasing & Supply Education & Research Association) Conference is held in Athens, Greece from 25 - 28 March 2018. This volume contains all the papers that will be presented at the conference and is distributed electronically to the delegates. The proceedings are organised into three sections. Part A contains all the competitive papers, Part B contains all working and Part C all the practitioner papers. The papers are listed in alphabetical order (by first author's last name) in each part.

The theme for the conference is *'Purchasing & Supply Management: Fostering Innovation*. The choice of this theme reflects the growing importance of innovation for the purchasing and supply profession. The inevitable drive towards more sustainable development, the fast pace of business processes digitization of the fourth industrial revolution *(Industry 4.0)* and the introduction of enabling technologies such as blockchain are causing major disruptions in the way that supply chains are structured and managed. The current business environment necessitates perpetual supply chain innovation and creativity to stay ahead of competition.

We can observe a marked increase in the last 3-4 years in the number of papers presented at IPSERA conferences focusing on innovation, but this is the first time the conference theme has been dedicated to supply chain innovation. This year 18 papers specifically concern innovation, and a large number of papers that are classified under other themes also discuss themes related to supply chain innovation.

However, the conference also addresses a large number of other important topics within purchasing and supply management. Some of these other themes were this year proposed by scientific committee members, who have subsequently played a key role in managing the review process for papers submitted to their 'special stream', and they will act as chairs of these streams during the conference. The list of themes includes:

- Supply Chain Innovation (process innovation, sustainable innovation, NPD)
- Supply chain finance and financing
- Big Data & Analytics
- Sourcing and Contracting
- Public Procurement
- Supplier Relationships Management
- Demand Management and Forecasting
- Supply Chain Teaching Innovation
- Information systems and technology
- Supplier selection and evaluation
- Sustainability (social responsibility, purchasing ethics, circular economy)
- IoT and industry 4.0
- Purchasing Strategy and Organisation
- Supply Chain Risk management
- Supply Chain resilience and robustness
- Forecasting and Supply Chain Optimisation
- Healthcare Purchasing and Supply
- Supply Chain Theory Development
- Global supply chains
- Supply Chain Human Capital

In order to make the information and ideas presented at the conference promptly and widely available, participants in the conference were invited to submit written papers based on their presentation for inclusion in these refereed online conference proceedings. Each Competitive paper submitted for consideration was double blinded peer-reviewed according to the requirements. The extended abstracts of the Working and Practitioner papers were also peer reviewed by two reviewers. That is, papers were sent to two scholars who were asked to provide a scholarly judgement on the paper's suitability for publication.

176 papers were submitted to this year's conference. This presents a record for the history of IPSERA and signifies the increasingly important role of the purchasing profession. Following the review process, 148 papers have finally been accepted and distributed as follows:

- 54 Competitive Papers
- 90 Working Papers
- 3 Practitioner Papers

Competitive papers are often based on analysis of empirical data but may also be purely conceptual. In either case, these are generally at such a high level of quality that they are in principle ready for submission to an international scholarly journal; all competitive papers have undergone a double-blind review process and are maximum 15 pages in length. Working papers may also be empirical and/or conceptual but represent work-in-progress and are maximum 10 pages; in the case of working papers an extended abstract rather than the full paper has been double-blind reviewed. A selection of the best conference papers will be published in the Journal of Purchasing & Supply Management. Practitioner papers are written by people from (private or public) companies or organisations, although sometimes in collaboration with academics. These papers are maximum 7 pages and have also been double-blind reviewed although the focus of practitioner papers is less on the scientific rigour and more on practical perspectives and implications.

We would like to thank all the authors who responded promptly, willingly, and efficiently to their requests to referee papers, and to thank fellow members of the editorial board for their support. We are grateful to the scientific committee for ensuring the rigorous standards of all the papers.

We have been fortunate enough to work with a team of very talented and enthusiastic individuals that provided invaluable managerial assistance. The professionalism of Magda Laiou, Anna Bolosi and Alexandros Koressis, and our very competent and enthusiastic student volunteers made the organization of the conference a very smooth task.

We hope you enjoy reading the papers and attending the presentations at this year's IPSERA conference.

Mihalis Giannakis, Audencia Business School, Chair
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Table of Contents

A Resource-based View on the Role of Global Sourcing for achieving Sustainable Development Goals

Anthony Alexander[1] and Joe Miemczyk[2]
[1]University of Sussex, School of Business, Management and Economics, Falmer, Brighton BN1 9RH, UK
[2]ESCP Europe Business School, 527, Finchley Road London, NW6, UK

Abstract
This paper provides a conceptual synthesis from reviewing literature across the sustainable development and supply chain management fields and then applying to examples from the 'grey' literature. The paper addresses capacity building in the international development literature and supplier development in the management literature to understand the implication for global sourcing in achieving sustainable development goals. Key theories in the literature are considered with linked concepts combining to form a conceptual framework. Two sets of examples from Brazil and West Africa are covered to pilot the nature of the framework leading to an outline research agenda.

Keywords: sustainable supply chain capacity building
Submission category: working paper

Introduction

Multi-national corporations involved in consumer goods manufacture frequently involve supply chains that source their raw materials from developing countries. Indeed, such trade links between developed world consumers and developing world producers are as old as international trade itself, particularly amplified in the colonial and industrial eras. Today, as awareness of global communities is enabled by modern media, consumers are coming to be made more acutely aware of the impacts such trade may have on the people and natural world where the raw materials of their purchases originate. Corporations are thus prompted to act, declaring a range of initiatives such as promising sustainable cocoa production to halt the habitat loss leading to the threatened extinction of primates (McClean, 2017), to the conflict minerals laws seeking to prevent child labour in metal extraction in mobile phones. The list of such connections is long, but so far, it is not clear to see how firms seeking to improve their global sourcing processes are able to simultaneously meet the need to maintain their profitability, whilst also meet the need to improve the social and environmental impacts linked to their supply chains. This developmental paper seeks to bring together theory in global sourcing and strategic capabilities concerned with sustainable development, with international development theory, concerned with improving communities.

Background Literature

Initial consideration of the conceptual landscape finds a relevant perspective in the resource based view (RBV) (Barney, 1991), further developed in the supply chain (SCM) context as the extended resource based view (ERBV) (Lewis, Brandon-Jones, Slack, & Howard, 2010), developed in the environmental context as the natural resource-based view (NRBV) (Hart,

1995), and more recently for social aspects as the social resource-based view (Tate & Bals, 2016). Relevant features of these conceptual approaches are the role of performance indicators, process control and governance.

This literature review therefore examines the role of social and environmental indicators across the international development (ID) (UNSC, 2017) and supply chain / global sourcing literatures, the conflicting roles of transparency, stakeholder influence, power imbalances (Touboulic, Chicksand, & Walker, 2014), network maps (Henneberg, Naudé, & Mouzas, 2010) and governance gaps (Ruggie, 2002). A theory for supplier capacity building for sustainable development may need to reconcile the nature of these factors. Synthesising these issues across two streams of literature - supplier development for sustainability as an aspect of supply chain management (SCM) and community capacity building as an aspect of international development (ID) helps build bridges between these two academic subjects and their related practitioner communities.

In SCM, supplier development is a well-recognized approach for improving the short and long-term capabilities and performance of suppliers (Hartley & Jones, 1997; Krause & Ellram, 1997; Krause, Handfield, & Scannell, 1998; Sánchez-Rodríguez, Hemsworth, & Martínez-Lorente, 2005). The goal of supplier development is to bring underperforming suppliers to a buyer's expected level of performance across quality, delivery, cost structure, new technology adoption, financial health, product design, and/or other important performance issues (Krause, Ragatz, & Hughley, 1999). Buying organizations need to invest in knowledge sharing activities to help suppliers internalize process and business level capabilities. With regard to sustainability, Vachon and Klassen (2008) called this environmental collaboration, to include training, on-site actions with suppliers' production processes and operations to improve their environmental impact, and mutual projects to develop innovations.

In the ID literature, a related concept to supplier development is capacity building. The United Nationals Development Programme (UNDP) defines capacity building as a 'long-term continual process of development that involves all stakeholders including ministries, local authorities, non-governmental organizations, professionals, community members, academics and other appropriate internal and external entities'. Others specify capacities ranging from intellectual, organisational, social, political, cultural, representational, material, technical, practical, or financial – and most likely a shifting combination of all of these (Eade, 2007). While capacity building is not always aimed at business organizations, there is a focus on transferring knowledge to local entities in order to improve process and practice, and focus on organisational learning (Jones, 2001). Yet a key difference with supplier development is the scope and inclusion of multiple stakeholders in the capacity building process and the transfer of knowledge across multiple organizational boundaries. Some criticism of this approach however highlights the one-way nature of knowledge transfer (Eade, 2007; Jones, 2001).

In the context of sustainable development, especially with regard developing market communities, supplier development and capacity building can be seen as related activities. In the case of Fair Trade coffee, the key benefits of a fair trade mechanism is the ability to help coffee producers develop their capabilities and perform better in the global coffee markets (Raynolds, 2004). A key feature is including local parties, such as financing institutions, in the improvement processes of local producers in order to create an external environment that can support the producer or supplier (Bäckstrand, 2006). However, Fair Trade itself has been criticised as 'private regulation', supplanting local institutions in the regulatory process. Hence, supplier development and capacity building can be seen as complementary and could provide more effective ways for local producer to meet sustainable development goals (Hajer et al., 2015). One concerns a focus on the supply chain and the desire of an international buying firm

(often a multi-national corporation, MNC) to improve performance of a supplier, and the other concerns a focus on a community or organisation in order to improve delivery of a social, environmental or economic development activity.

From the perspective of a buying firm seeking to improve the sustainability of its supply chain, it is unclear how to properly leverage the overlap between these two approaches. On the one hand, the strategic management theories around RBV state that firms are fundamentally concerned with competitive advantage, strengthened by developing appropriate capabilities in their global sourcing. On the other, they must simultaneously be attentive to the needs sustainable development encountered in the local context of the supplier organisations or related communities. This prompts a number of initial guiding questions addressing issues of competitive strategy whilst also meeting social and environmental challenges:

1. How does a combined extended, natural and social resource-based view develop our understanding of sustainable SCM and the role of MNC global sourcing policies?
2. Which sustainability challenges benefit from MNC strategic resources in supplier development / capacity building and how to manage and measure this impact?
3. How can this view reconcile levels of analysis from organisation, supply chain to a macro-scale of sector market-level changes and societal scale changes?

The first question concerns the strategic resource allocation decisions of buyers - often MNCs. At the level of theory, we are concerned with matching the RBV/ERBV/NRBV/SRBV approaches with SSCM and global sourcing to meet sustainable development or associated social, environmental and economic concerns. This is process of theory synthesis (Rousseau, Manning, & Denyer, 2008) involving the creation of a conceptual framework.

The second question concerns how sustainability challenges are defined. The current international policy landscape is orienting around the United Nations' Sustainable Development Goals (SDG), a series of agreed targets to improve social and environmental concerns. The SDG are a set of issues that national governments seek reportable metrics around. Businesses and investors are also using the SDG as a means to channel activity towards addressing sustainability, and in doing so prompt a need to verify the effectiveness of this activity. This is a central topic in the emerging field of impact investing.

The need for performance indicators, process control and governance is seen in the strategic management literature as an essential component of effective action, and this can clearly inform the impact investment community and its related interaction with the SDGs (Bebbington, Unerman, & O'Dwyer, 2014). Key performance indicators linking economic, social and environmental criteria within the supply chain, such as via supplier contracts, supported by a sufficient and reliable level of transparency of data, is required. Process control then refers to the ability to manage the performance of the supply chain on the basis of that information. Supplier development therefore proceeds on the basis of needing the goals for economic value to be generated by the buyer, also by the supplier, and also, simultaneously, for social and environmental outcomes (potentially modelled using the concept of 'public value', in contrast to pure economic value, such as by Bozeman (2002); Moore and Bennington (2011) to complement the specific targets of the SDG).

The element of governance is important in ensuring visibility, control, and corporate responsibility, over the upstream supplier, plus the nature of a suitable legal framework and level of national government responsibility. Various cases where commodity chains become non-transparent to buyers are common across many commodity types. Often when a product enters a market, its provenance is no longer knowable, and various attempts to prevent this 'laundering', through a black-box process of a market can be seen (for example, the 2012 US

Dodd-Frank Act clauses requiring buyers declare their awareness of their upstream supply chain and whether it includes minerals from designated 'conflict zones' (Narine, 2012)).

With an awareness of both a governance gap and an information gap, it may be thought that additional regulation and additional visibility, such as via auditing or better data architecture in a supply chain, these problems can be overcome. However, the objective outlined in the SDG policy framework may be at risk of assuming a structured performance measurement and management approach when in reality the deficit of information on required metrics and the underlying complexity of the context prevents easy accounting solutions for the impact in social and environmental terms of a given investment in supplier development (Alexander, Kumar, & Walker, 2018). Exploring and overcoming such limitations where possible may be is an important aspect of current and future research into SSCM and related topics.

The third question concerns levels of analysis or scales. Using the SDG as a normative set of criteria around which to define sustainability, the subdividing of these into a set of metrics prompts a further consideration of the architecture for performance measures, and how this extends from the local and specific scale of a given community or organisation deemed to be the supplier, and the related supply chain or supply network back to a given buyer. This vertical line or network can then be contrasted with a horizontal one, across a given spatial location, up to the scale of a sovereign nation, or across an economic sector of buyers, such as, say, palm oil. The role of cross-sector trade bodies seeks to aid maturity of this horizontal coordination.

Whilst a single MNC may wish to engage in supplier development (SCM) with a view to improving capacity of a given community (ID), and make a case for impact investing aligned with the SDG, a central issue of concern to both the impact investor and to the local government, will be to establish how significant that action is in achieving a macro-scale meeting of an SDG, how many such MNC actors might need to act together in order to make a substantial difference on these SDG, and hence whether the impact can really be legitimately claimed. An understanding of scale is therefore of central relevance .

This stage of the research concerns outlining of the conceptual framework. This is undertaken primarily by a literature review and subsequent thematic and conceptual synthesis, to then be extended by an initial elaboration of known case studies in the grey literature and primary research projects at an early stage of development. This paper continues by outlining the literature review undertaken thus far, a formulation of the initial conceptual framework, and an initial, basic application of this to case studies (in West Africa, concerning the cocoa supply chain, and in Brazil concerning the açai berry and brazil nut supply chain). Initial issues and challenges are then discussed, followed by an outline of next steps.

In summary, the strategic management theories of RBV and its extensions concern how the resources and capabilities a company has underpin its competitive advantage. Extending this into supply chain management and global sourcing strategies means developing supplier capabilities in order to support the buying firm's strategy. However, a significant limit to current theory is the role of multiple buyers with the same goals, hence questioning the traditional view of competitive advantage. Typical factors used are performance objectives such as product or service quality, speed or reliability of delivery, cost structure, etc. In environmentally-focused supplier development, this often involves training suppliers in new standards, improved process design (such as greater efficiency), collaboration on innovation in products or services to advance environmental (or social) performance, etc. (Vachon & Klassen, 2008). This involves various performance measures and related management processes, with the relative level of knowledge or transparency, the relative power of the

buyers, suppliers or other stakeholders, and the nature of governance and regulation, and related gaps. Meanwhile, from the perspective of international development (ID), capacity building is often also focused on organisations, including businesses, and also communities (which, in some cases, may be classed as micro-businesses, artisan businesses, or co-operatives) i.e. a different level and unit of analysis. Here, as the focus is often at a more aggregated level of a particular community, at various scales from the local up to the regional or even national, multiple stakeholders are assumed, and so multiple routes for organisational learning are considered. These various components are summarised in Figure 1, below. The goal of bringing these different elements together is in order to establish a potential 'theory of supplier capacity building for sustainable development'.

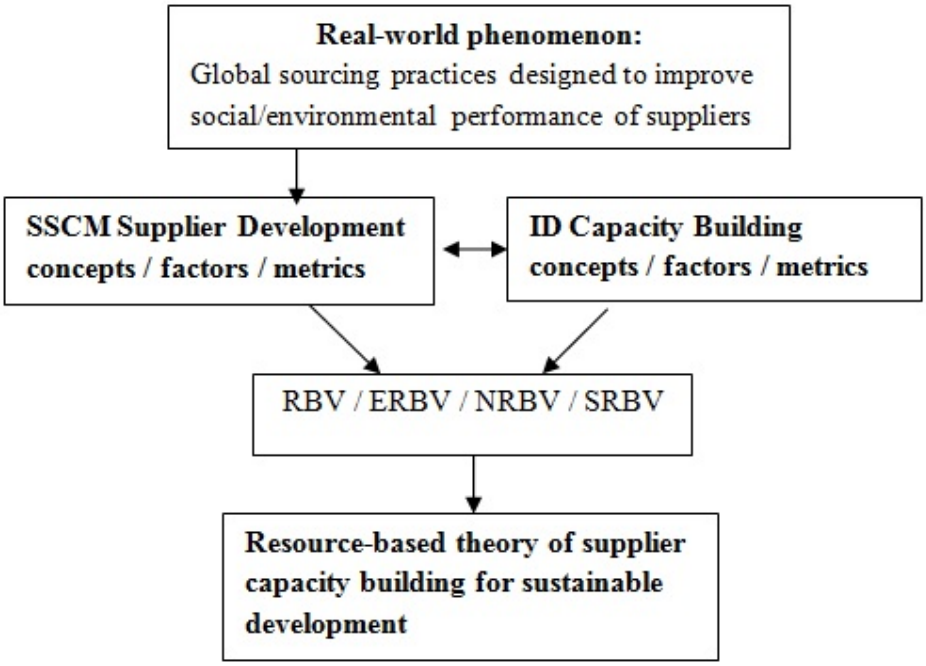

Figure 1: initial draft of conceptual framework based on background literature.

Methodology

Bringing these various themes together requires a focused and systematic literature review. This current paper provides an outline of this, with the bulk of the review itself to follow in a future paper. Here, the conceptual framework is mapped and initial findings discussed. The methodology for systematic reviews is that outlined by Briner and Denyer (2012); Denyer et al. (2008); Tranfield, Denyer, and Smart (2003), widely used in SCM research (Alexander, Walker, & Naim, 2014; Gimenez & Tachizawa, 2012; Miemczyk, Johnsen, & Macquet, 2012). The stages of this require a checking of key search terms, clear recording of the criteria used to conduct the search to enable replication and extension by other researchers, and a broad and interdisciplinary approach to ensure that insights to a topic from other disciplines are addressed and not lost in isolated academic silos. A similar analysis is being undertaken with academic, secondary sources, media/press reports and third sector reports in order to build case evidence.

Initial Analysis

Table 2, below offers a broad-brush synthesis of concepts from SSCM supplier development and ID capacity building to provide an initial typology against which to group the research found in the literature review (Table2). This clustering of concepts is a simplification process that provides an initial scan of the literature. Future analysis will take this process further, highlighting additional richness and detail that aids the usefulness and explanatory power of the review. For now, this initial synthesis finds two categories, operational issues and stakeholder issues. Broadly, these refer the performance management considerations led by the main buyer, and through which they seek to influence the supply chain, and the stakeholders include a wide range of parties and relationships that will influence the success of the firm's objectives.

SSCM **Typical factors in supplier development** (e.g. Vachon and Klassen, 2008)	**ID** **Typical factors in capacity building** (e.g. Eade, 2007)	**Combined SSCM and ID View on supplier development and capacity building** Combined list of concepts to form initial typology for literature review.
• Performance indicators (e.g. quality, delivery, cost structure, new technology adoption, financial health, product design, organisational learning, etc.) • Process control • SC Governance • Levels of transparency • Levels of stakeholder influence and power imbalances (incl. collaboration for innovation, network structure, governance gaps)	• Specific outcomes - local context - temporal and spatial scales - measuring & reporting on progress • Co-ordination of multiple buyers and suppliers to achieve progress at macro-scale. • Access to financial support • Access to technology and expertise • Multiple stakeholder dialogue • Multiple organisational learning (community level)	**Operational factors** • Performance objectives • Performance measurement • Process design & control **Relational factors** • Buyer-supplier relationships • Community cooperations • Sector cooperations **Financial factors** • Supplier investment support **Stakeholder factors** • Customer values • Governance and institutional voids

Table 1: Initial synthesis of SSCM and ID into two category typology

While stakeholder theory can be considered in relation to Freeman's work in the 1980s and subsequent iterations over the following 30 years, it can also be considered in terms of theories of network maps, social capital, power and influence, which can extend beyond the central disciplines of strategic management. As a concern of a typical MNC buyer, the link between their procurement policies and tangible contribution to a sustainable development goal suggests a need to anchor international development concepts into a strategic management frame.

Main concepts

The analysis of the literature to date shows that many SSCM papers are clearly identifiable as related to either operations management topics or to stakeholders. Operations concepts primarily include performance measurement (Yawar and Seuring, 2017) and supplier selection decision analysis. Stakeholder concepts cover inter-organisational relationships between buyers and suppliers (Kumar and Rahman, 2016), with NGOs (Rodriquez, et al. 2016), or with government (Edmonsdon et al. 2008; Lauridsen, 2004), or multiple parties (Yadlapalli et al., 2018; Liu et al. 2018). Some papers explore the barriers to effective sustainability-related supplier development (Busse et al. 2016) and others provide data suggesting that there is no economic benefit in such supplier development (Sancha et al. 2015). Overall, supplier development appears to be a growing topic of discussion in the SSCM literature, extending common theoretical approaches from supply chain, procurement and sourcing research in business and management scholarship.

The ID community by contrast takes a different approach, based on the specific evolution of that discipline and its areas of focus. Here, there is a larger number of papers across a wide range of journal titles. The approach taken is, however, very different to that of business and management scholarship. This is perhaps unsurprising in terms of the focus of the subject matter, but notably there is a difference in methodology and the use of theory. A significant majority of the papers are case studies. These largely describe a specific ID project and its context, offering some reflections and suggestions based on the findings. Notable clusters of topics are health, education, policing and climate policy. These papers are also largely a-theoretical. Few papers appear to draw foundations from organisational theory, though some papers are explicitly theoretical, drawing on evaluation theory and 'theory of change'. Some papers refer to stakeholders, but this is largely in relation to engagement between different groups, rather than the original strategic management meaning which supposes that there is a focal firm to whom stakeholders must be managed in order to achieve strategic objectives.

Notably, given the topic of this paper, there is almost no mention of the Sustainable Development Goals (SDG) in either sets of literature. This suggests firstly that there is a research gap on this topic. Secondly, that synthesis between the SSCM and ID perspectives on stakeholder engagement and performance measurement may be significant in informing the SDG agenda. Firstly, from an operations management and decision analysis point of view, the extensive number of indicators (performance measures) by which national governments will be held to account in their success or failure in meeting SDG contains some extremely familiar challenges over ambiguity, contradictions and trade-offs; resistance, gaming and unintended consequences; bounded rationality, incomplete data, and institutional bias. These areas are studied in business and management scholarship, but perhaps less so in the development literature that informs the SDGs. Future work will look at this in more detail.

The next section seeks to elaborate some of the broad concepts covered in Table 2 in relation to two case studies being investigated by the authors. These will offer the basis for a parallel consideration of conceptual model and real-world phenomenon in order to enable theory elaboration as the research project moves forward. Notably, the large number of metrics and indicators associated with the SDGs are tested in some specific contexts faced with obvious sustainability challenges. To date, these cover two cases concerned with meeting the sustainable livelihoods of forest-dwelling communities while countering the intractable problem of accelerating levels of deforestation.

Case study 1: Brazil

A specific community is being assisted in developing non-timber resources as a means to establish sustainable development and counter the short-term economic lure of logging. A number of crops are already being harvested for export. These include brazil nuts and açai berries. In this case, there is a clear territory, with a coherent community engaging with international buyers directly as well as through local markets. Supplier development initiatives are focused on providing small-scale local processing to increase the value of the commodities, including by improving transportability and quality control. Additional development actions concern mapping the territory to establish possible increases in yield of food products harvested from the wild (such as brazil nuts). A range of SDGs are being considered as performance metrics against the supplier development initiatives but there is as yet no link between the small scale, local level of activity, with the macro level.

Case study 2: Côte D'Ivoire

This case concerns the well known and much written about sustainable cocoa supply chain in in Cote D'Ivoire (which accounts for around 33% of global supply). In contrast to the previous example this supply chain is characterised by a complex network without a clearly defined single territory for the production and processing of cocoa beans. The role of trading companies and the commodity nature of the product means that gaining traceability is a particular challenge. However as in the case above the challenge to provide greater levels of value add and yield in the production locality and to support sustainable development goals is a key focus for a number of stakeholders in the locality as well as from global MNEs sourcing from the region. In particular the Côte d'Ivoire Sustainable Cocoa Initiative bringing together national governments (in CI and Europe, trade bodies and private companies), specifically to help build capacity/capability in the production of cocoa in a sustainable way. Similar to the case above the production is often within vulnerable forestry areas carried out by local farmers. The main supply chain stages are cocoa bean growing and grinding, before shipping to Europe or the US for use primarily in confectionary products. While the bean production is spread across many thousands of small holders (and some larger cooperatives), the grinding process is concentrated to major purchasers Cargill, SAF Cacao and ADM, some operating large capacity processing plants mainly in Abidjan and San Pedro. However the majority of exports (90%) are beans, with exports are divided between a few very large players mentioned before plus Nestle, Kraft, Ferrero for consumer products. Supplier development and capacity building issues centre round the adoption of sustainable cocoa production at the grower level and the inclusion of more value add in Cote D'Ivoire to support greater economic and social sustainability.

Conclusion

In the regional examples, from West Africa and Brazil, supply chains stretch between multinational corporation (MNC) purchasers and low income agricultural suppliers facing environmental impacts and social imperatives. Multiple levels are explored from market-scale impacts of an MNC to the local impacts of a borderline subsistence farmer, various structures are explored. Key nodes are intermediary wholesalers, or workers co-operatives, including in the processing of commodities (Marsden & Smith, 2005) highlighting structures of supplier development and link to provenance and transparency challenges. Supplier capacity building for sustainable development is dependent on these structures of the supply base in such countries. Identifying these forms is important where reports of barriers to sustainable development are prompted by over-dependency on natural resource exports (whether agricultural or mineral) and related exposure to commodity price volatility and outward migration of capital (noted by UNCTAD), hence a need to move up the value chain.

From a strategic management perspective, international development questions can be interpreted as design of the supply chain network and location of value add activities to fund and build capacity. Numerous anti-MNC campaigns by environmental and development NGOs have exposed a lack of delivery in the face of high sounding targets for progress (whether net zero deforestation, net zero carbon, sustainable palm oil, sustainable cocoa, etc.). Hence MNCs are struggling to realise objectives with current capabilities and are still exploring the most suitable strategy given global standards and local specificities (including political/institutional, financial, infrastructure, skills base and so on).

The conceptual framework that is emerging from the research suggests that the application of RBV to this topic highlights the role of governance, to control and monitor, of capability, to have the resources and abilities to deliver, in order to have a meaningful impact on performance. Yet this needs to reconcile the fair appropriation of value in the supply chain and the question of competitively valuable capabilities whereby capacity building is supported and facilitated by competing firms with common supply chain goals but competing market share objectives. By developing this further, a bridge may be developed between the macro-scale indicators of SDGs (and MNCs promoted targets to support these) and the micro-scale context of supply chains, affecting specific communities and habitats, at the national, regional and local scale.

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SUPPLY CHAIN MANAGEMENT'S ROLE IN ACCELERATING INCLUSIVE GROWTH AND SOCIO-ECONOMIC DEVELOPMENT

Intaher Marcus Ambe
School of Public and Operations Management
University of South Africa
Email: ambeim@unisa.ac.za

ABSTRACT

This paper investigates the extent to which supply chain management is implemented in a South African provincial government and its role in accelerating inclusive growth and socio-economic development. Since 2004, supply chain management has gained significance, with regard to the procurement of goods and services by means of fair, competitive and cost-effective systems and processes. It is being used as an enabling mechanism for the South African government to implement policy towards inclusive growth, socio-economic development and transformation. The paper is exploratory and descriptive in nature and based on a survey conducted among supply chain practitioners in a provincial government. Based on the findings, the paper revealed that supply chain practitioners acknowledge the strategic role of supply chain management towards inclusive growth and socio-economic development. However, the maturity of supply chain management implementation is still in an infancy stage and it is not sufficiently used as a strategic. It is evident that the lack of proper implementation of supply chain management may be the root cause of inefficient inclusive and socio-economic development problems in the province. There is need to re-organise and re-align organisation structures in the province to elevate supply chain management practice. The paper recommends three pillars which are critical for accelerating inclusive growth and socio-economic development in the province.

Key words: Supply chain management, inclusive growth, socio-economic development, provincial government, South Africa.

1 INTRODUCTION

Supply chain management (SCM) is a transformation tool in the South African public sector. Since 2004, it has gained significance, with regard to the procurement of goods and services by means of fair, competitive and cost-effective systems and processes (Bent, 2014:14). It is being used as an enabling mechanism for the South African government to implement policy towards socio-economic development and transformation (National Treasury [NT], 2015: 1). The concept of SCM was adoption in the South African public sector management due to the lack of interpretation, accountability and implementation of the preferential procurement policy adopted after the first democratic election. With the adoption of SCM, a roll out implementation plan was established and a generic SCM policy developed (Bent, 2014:15). Since then, SCM has been transformed and the National and Provincial Treasuries embark on training to educate and capacitate SCM practitioners.

However, the potential of SCM is yet to fully achieve. The Auditor General's reports over the years indicated that SCM practices is characterised by fraud and corruption. There is pressure from citizens, service providers and the media on the potentials of SCM towards service delivery excellence (Business Day Report, 2011). The National Treasury (2015) review revealed that the strategic importance of SCM in the South African public sector is not well

understood and SCM is imperfect. There are constant allegations of corruption and inefficiency. Service delivery protests are evident on daily news Medias which are a sign that people feel that they are not receiving the quantity or quality of services they need. Other factors that prevent that affect efficient SCM implementation are: SCM not considered as a strategic function; lack of organisational structures and systems in place; lack of accountability; lack of clarity of roles and responsibility; lack of skills, knowledge and capacity; policies and regulations overlap; confusing and cumbersome; lack of supplier management relationships; strategic balance between major procurement objectives. Hence, the National Treasury have embarked on series of SCM developments in an effort to enhance SCM implementation in the country in line with the National Development Plan (NDP) 2030 vision. According xx, the pace of transformation has been slow and the government has set it sight on transformation and to re-dress unemployment, poverty and inequality. According to the NDP's vision 2030, long-term accelerated economic growth aimed to reduce unemployment and inequality and help create a more inclusive society.

While there has been numerous studies on SCM implementation in the South African public sector (Migiro and Ambe, 2008; Matthee, 2006; Van Zyl, 2006; Ambe and Badenhorst-Weiss, 2011), as well as inclusive growth (Ranieri and Ramos, 2013; Samantha, 2015), there are limited studies on the role of SCM to inclusive growth and socio-economic development especially in the South African context. This paper therefore intends to fill the void. Hence, the purpose of this paper is to:

- Investigate the extent to which supply chain management is implemented in accelerating inclusive growth and socio-economic development in a South African provincial government.

This paper is of utmost importance, as it gives an understanding of the state of SCM implementation in the province. It also contributes to increasing the body of knowledge in the field of SCM, especially on the role of SCM to inclusive growth and socio-economic development in the South African public sector context. The remaining section of the paper presents a theoretical review of SCM and it role to inclusive growth, the research methodology employed, the findings and discussion as well as a conclusion.

2 LITERATURE REVIEW

This section of the paper presents a theoretical review of SCM and inclusive growth. It begins with an overview of SCM in the South African public sector and in South Africa, followed by an overview of inclusive growth and the drivers of SCM to inclusive growth and socio-economic development.

2.1 Supply Chain management in the South African Public Sector

SCM is an important concept in today's business environment as it contributes significantly to the bottom line (Agus, 2011:269). SCM encompasses the planning and management of all the activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers and customers. SCM can also be approached from different disciplines (Arlbjørn, Freytag and de Haas, 2011:277), namely logistics, purchasing, transportation, operations management, marketing and research (De Haas, 2011). Countries such as the UK, US and Canada have long employed SCM in the management of their procurement and logistics (Mwilu, 2011:3). In the South African public sector, SCM is an integral part of financial management and it is considered a strategic tool for

managing procurement practices. Since 2004, SCM in the South African public sector supply chain has undergone transformation through the introduction of procurement reforms. Hence, SCM is an important aspect of service delivery to governments.

For more than two decades, the South African public sector supply chain has undergone transformation through the introduction of procurement reforms. The procurement reforms began in 1995 and were directed at two broad focus areas, namely, the promotion of principles of good governance and the introduction of a preference system to address socio-economic objectives. The procurement reform processes were embedded in section 76(4) (C) of the Public Finance Management Act (PFMA) and the Preferential Procurement Policy Framework Act (Act 5 of 2000) (PPPFA) (SAMDI, 2005). In 2003 the South African Cabinet adopted a SCM policy to replace these outdated procurement and provisioning practices. The aim was to implement a SCM function across all spheres of government, which would be an integral part of financial management and would conform to international best practices (National Treasury [NT], 2005). The SCM policy framework aimed to promote uniformity and consistency in the application of SCM processes throughout government; facilitate the standardisation and uniform interpretation of government's preferential procurement legislation and policies; as well as complete the cycle of financial management reforms introduced by the PFMA by devolving full responsibility and accountability for SCM related functions, in addition to financial management functions, to accounting officers and authorities (Mkhize, 2004; NT, 2005).

The government over the years have made numerous enactment of procurement reforms and the introduction of SCM as a procurement and socio economic tool, numerous trends and developments have evolved. The National Treasury publishes policies, regulations, practices notes to guide SCM practitioners in government. In 2015, the National Treasury published the first review of the SCM policy, the first major assessment of the system of buying goods and services by the public sector since 2004. In 2011, the Preferential Procurement Regulations provided guidelines for the implementation of the 80/20 and 90/10 preference point systems. A revised preferential procurement policy regulations 2017 made provision for changes with the aim to accelerate inclusive growth and transformation such as tenders targeting specific groups, such as black women; increase of the threshold for 80/20 from 1million to 50 million and 90/10 above 1 million to above 50 million. Also, there is emphasis on procurement of locally manufactured goods and services as well as compulsory subcontracting of at least 30 per cent for tenders above R30 million where feasible, to advance designated groups. Also, in 2015, a revised Codes of Good Practice was enacted to change the way Broad Based Black Economic Empowerment (B-BBEE) scorecards developed in 2003 are calculated.

2.2 Drivers of supply chain management towards Inclusive Growth

Inclusive growth is of high relevance in today's global economy, offering an opportunity to mitigate inequalities and stimulate economic growth (Asian Development Outlook, 2012). Inclusive growth means making sure everyone is included in growth, regardless of the economic class, gender, sex, disability and religion (Ranieri and Ramos, 2013). It takes on a long-term perspective and focus on productive employment. Thus inclusive growth approach took a long-term perspective of development. Anand, Mishra, and Peiris (2013) asserted that the growth is said to be inclusive when it is sustainable in the long run and broad based across different sectors. Inclusive growth has become a central concern in developmental literature and policy decision making in many countries (Ranieri and Ramos, 2013). It has been used in countries such as the USA, Brazil, Viet Nam as well as in Ghana to boost growth, reduce unemployment and inequalities (Samantha, 2015). In South Africa, slow economic growth has

placed enormous pressure on the government finances resulting to the need for inclusive growth. Hence, the need for effective public procurement practices. According to National Treasury (2017), to realise the vision of the country, transformation is needed to open a path to inclusive economic growth and development. The National Development Plan's vision is that, in 2030, long-term accelerated economic growth has reduced unemployment and inequality and helped create a more inclusive society. This is in part due to diligent work in carrying out growth plans such as the New Growth Path, the Industrial Policy Action Plan and the National Infrastructure Plan.

SCM drivers are critical for enhancing the maturity of inclusive growth and socio-economic development initiatives. From a supply chain point of view, maturity can be defined as the level of adoption or realisation of modern collaborative and integrative practices (Bowersox, Closs, and Cooper, 2010). Randeree, Mahal and Narwani (2012:477) defined supply chain maturity as a staged structure of the extent to which a supply chain function has progressed by effectively adopting new processes and best practices. There are however, different dimensions to supply chain maturity as well as no unanimous definition exists (Schiele, 2007:276; Rudzki and Trent, 2011). In this paper, the following dimensions were considered strategic for enhancing the maturity of supply chain practices towards inclusive growth and socio-economic development in the South African public sector:

- **Understanding the strategic importance of supply chain management:**

SCM is one of the strategic mechanisms enabling government to implement policy. Traditionally, SCM has been misunderstood and undervalued. Its strategic importance has not been recognised, and it has been under-capacitated. According to the National Treasury (2015) review, the strategic importance of SCM is not well understood. SCM is explicitly in the public sector in South Africa to pursue socio-economic objectives. Understanding the strategic objective of SCM is therefore imperative (Boateng, 2015).

- **Strategic sourcing and commodity management**

Strategic sourcing is a collaborative, structured approach to analysing government's spending; using the information from this analysis to acquire commodities and services effectively; and as a result supporting government's service delivery objectives. It helps supply chain managers to plan, manage, and develop the supply base in line with these objectives; and creates an understanding of the categories of goods and services in government's spending portfolio, their intended use and the sources of supply (Boateng, 2015). This helps to identify the leverage points, develop appropriate sourcing strategies, reduce costs and increase the benefits and value of the service or commodity to government. The successful implementation of strategic sourcing may lead to an improved understanding of government spending patterns that will assist in optimising the budgeting and planning process and enable sourcing practitioners and decision makers to make better informed decisions (Reuter, 2017). The South African National Treasury in 2015 developed a strategic sourcing framework. The sourcing requires that government adopted a differentiated approach to procurement of the various commodity groups. Using the principles of strategic sourcing means distinguishing between the various categories of commodities and developing appropriate sourcing approaches for each. Categorised commodities presents a proven framework for transforming procurement operations to increase the value the department provides to its organisation. The framework categorises commodities in the country into strategic products, leverage products, routine products as well as bottleneck products (Mail & Gaurdian, 2015).

- **Procurement spend analysis and total cost of ownership (TCO)**

Spend analysis is one of the key tools that procurement organisations use to proactively identify opportunities to optimise their organisation's buying power. Government spends close to R600 billion annually on goods and services, and inefficiency should be a big concern in the procurement processes (Reuter, 2017). In line with the 2017 revised preferential procurement regulation, Departments and municipalities need to set procurement spending targets for SMEs, youths, women, disabled etc. The government has set itself the target of procuring 75% of goods and services from South African producers as part of its drive to create a new class of black industrialists and entrepreneurs (Ramaposa, 2014). With regards to total cost of ownership (TCO), Fawcett, Ellram and Ogden (2007:263) defined (TCO) as a philosophy for understanding all relevant supply chain related costs of doing business with a particular supplier for a particular good/service, or the cost of the process, or a particular supply chain design. TCO enables organisations to understand all specific cost drivers for goods and services and the resulting components that can be used to reduce overall cost. Understanding TCO broadens our baseline understanding of spend and identifies sourcing opportunities beyond purchase price. TCO identifies costs which are made up of two major components - direct and indirect. In the SCM policy, TCO is an important component of the demand management process referred to as TCO or Life Cycle Costing. Consideration for TCO is required in the development of the specification. This is particularly important for the procurement of assets, from need through planning to disposal.

- **Enterprise and supplier development**

Enterprise and supplier development (ESD) within the context of the South African BBBEE scorecard is defined as a program of developing SMMEs, called beneficiaries, by investing time, money, and capital in order to contribute to the development, sustainability, financial independence, and operational independence of those beneficiaries. According to the BBBEE Act, ESD is a combination of preferential procurement, enterprise and supplier development. Leveraging procurement to influence the development of the local supplier industry is key to realising Government's objectives relating to growth, employment creation and equality Morales-Nieto (2008). Pooe (2016:3) define ESD as the process of strengthening the integration of small firms with potential growth and expansion into the economic mainstream. ESD is a critical of the qualifying contributions which can reflect positively on an organisation's BEE Scorecard. ESD measures the extent to which organisations buy goods and services from suppliers with high BBBEE recognition levels. SMMEs contribute significantly to growing the economy; generally referred to as "drivers of economic growth" (Sithole, 2014). ESD alone contributes 40% of the entire BBBEE scorecard. Developing an ESD policy and objectives is imperative. Small Businesses represent 98% of the firms in South Africa, but only have a 9% survival rate over a 10-year period. For this reason, the major emphasis of ESD is the long term sustainability of these small businesses. According to Accenture (2012), the government is legally binding and have an obligation to develop suppliers and participate in ESD initiatives.

- **Supplier performance and contract management**

SCM performance exerts considerable influence on the actions of organisations as a result; most of these businesses realise that, to evolve an efficient and effective. Performance measures such as cost savings, quality, on-time delivery, and efficiency are not included in SCM scorecards (Accenture, 2012). For performance to be managed it needs to be measured first, an organisation must identify and implement a supply chain performance measurement system which bests suits the objectives of the organisation and such system must be aligned with the

organisational strategic goals. According to Ambe (2016), there are inefficiencies in contract performance, monitoring and evaluation mechanisms. Failure to monitor contract performance results in non-completion and or late completion of government projects". The are several reports of poor supplier performance and late delivery of projects in government. Supplier performance is usually done outside the SCM processes. SCM responsibility ends when a supplier is appointed (Accenture, 2010:3). The supply chain practitioner's key performance indicators are not linked to the overall business objectives; this is more prevalent in government where SCM is regarded as a procurement tool for accelerating transformation and inclusive growth, hence, the need to assess and properly manage contracts (Charan, Shankar & Baisya; 2008: 513).

- **Supply chain management implementation challenges**

SCM was introduced in the South African public sector was to introduce internationally accepted best procurement practice principles, while at the same time addressing Government's preferential procurement policy objectives (Office of Government of Commerce [OGC], 2005). It was aimed to address deficiencies in practices related to procurement, contract management, inventory and asset control and obsolescence planning (NT, 2003; Mkhize, 2004). Mnguni (2012:49) asserted that each government entity had to adopt SCM policy to suit its needs (NT, 2015:1). By virtue of the adoption of SCM practices in the South African public sector, national and provincial departments; local government (municipalities) as well as parastatals are expected to implement SCM efficiently and effectively to ensure good governance, preference and the socio-economic objectives of the country. Notwithstanding the adoption of SCM policies and practices across all spheres of government, its implementation remains a challenge, especially in local government. Universal challenges facing government SCM are suboptimal operational performance, weak corporate governance, poor performance of the board, corruption, political influence and poor service delivery (PWC, 2015:2). There are evidenced in daily reports of irregularities in newspapers, television, radio and social media. A report by the Auditor General of South Africa (AG) (AG, 2010- 2015) highlights challenges of non-compliance and irregular expenditure.

Following presentation and an overview of SCM as a driver to inclusive growth and socio-economic development and the challenges thereof, the next section of the paper presents the research methodology.

3 RESEARCH METHODOLOGY

This paper investigates the extent to which SCM is implemented in accelerating inclusive growth and socio-economic development in a South African provincial government. The paper is descriptive and exploratory in nature based on a survey conducted in a provincial government in South Africa. The provincial government embarked on SCM reforms in line with the National Treasury imperatives to ensure that, there are efficient use of its resources on the procurement of goods and services to drive socio-economic development and inclusivity of resources. The provincial government constitute twelve departments, five district municipalities and associated local municipalities as well as five provincial entities. A survey was conducted on senior supply chain managers in the province based on face to face interview (provincial department, municipalities as well as municipal entities). A purposive sampling technique was used and the focus was on senior supply chain managers (Head of supply chain) with expert knowledge on supply chain practices. Specific participants for interviews were thus selected according to their strategic positions and seniority in their organisations. The interview questions were semi-structured and measured using a five-point Likert response format with the end points (1) "strongly disagree" and (4) "strongly agree". A total of 55 (N = 55)

interviews were conducted from 20 provincial departments, 25 municipalities and 10 provincial entities. The data were analysed descriptively using the Statistical Package for Social Sciences (SPSS).

4. FINDINGS AND DISCUSSION

This section of the paper presents the results and discussion.

4.1 Presentation and Analysis of Findings

Five driver of SCM towards inclusive growth were empirically investigated. Presentation, analysis and interpretation of the results are discussed under different sub-headings such as the strategic importance of SCM, strategic sourcing, enterprise and supplier development, supplier performance management, commodity management, procurement spend analysis, total cost of ownership, challenges in the supply chain as well as the contribution of SCM to socio-economic development as indicated below:

- **Strategic importance of supply chain management**

Respondents were asked to indicate on a five-point Likert response format with end points 1 (strongly disagree) and 4 (strongly agree no extent), the extent to which they agree on the importance of their supply chain to inclusive growth and socio-economic development. The findings are presented in percentages as reflected in table 1.

Table 1: Perception of respondents on the strategic importance of supply chain management

Statements	SD	D	A	SA
SCM is seen as a back office role	17%	37%	30%	17%
SCM is a ticking box exercise	30%	52%	6%	12%
SCM helps to maximise limited resources in government	4%	15%	35%	46%
SCM is used to address inequalities of the past	2%	7%	40%	46%
SCM provide strategic direction in government	4%	9%	42%	45%
SCM is a regulatory instrument	6%	7%	44%	41%
SCM drives transformation to empower previously disadvantaged individuals	2%	9%	40%	49%
SCM contribute towards socio-economic development	0%	15%	30%	55%
SCM is contribute to SMMEs development	10%	27%	27%	37%

The results indicates that most of the respondents are of the view that SCM helps to maximise limited resources in government (81% agreement) and it is a transformation tool (79% agreement). It is important to note that most of the respondent do not believe SCM is ticking box exercise (82% disagreement). Interestingly, only 46% of the respondents see SCM as a back office role, hence, it is strategic towards the province socio-economic imperatives. Therefore, the practitioners do understand how strategic SCM is towards inclusive growth and contribute to socio-economic development [91% agreement]. All the respondents were of the view that SCM contributes to socio-economic development in the province. The respondents believe SCM drives transformation and restructuring to accommodate the previously disadvantage (89% agreement); and that SCM contribute towards job creation and the economy (85%). Furthermore, the respondents noted that regulatory regime change contribute to socio-economic development (89% agreement). However, only 62% of the respondents believe there is enough investment in the development of SMMEs (64% agreement). The finding alludes that SCM practitioners do understand how important SCM is towards inclusive growth and socio-economic development. However, implementation remains a challenge. The results

supports the fact that SCM is critical for the advancement of socio-economic development in the country.

- **Strategic sourcing and commodity management**

Respondents were asked to indicate on a five-point Likert response format with end points 1 (strongly disagree) and 4 (strongly agree no extent), the extent to which they agree on statement s regarding strategic sourcing and commodity management. The findings are presented in percentages as reflected in table 2.

Table 2: Perception of respondent with regards to strategic sourcing and commodity management

Statements	**SD**	**D**	**A**	**SA**
Strategic sourcing is aligned with organisation's annual procurement plan	16%	31%	29%	24%
Procurement plan are analysed for the purpose of developing sourcing strategies	13%	42%	25%	20%
Strategic sourcing process is concerned about quality	5%	18%	45%	31%
Strategic sourcing team conducts industry analysis	15%	35%	29%	22%
We have different categories of commodities	6%	24%	46%	24%
We conduct need assessment	7%	19%	48%	26%
We apply different procurement strategies for different commodities	9%	30%	41%	20%
We engage with key stakeholders during SCM processes	0%	23%	43%	34%
We perform market research before deciding on commodity strategy	11%	30%	28%	31%
We use simplified processes in the procurement of stationary and office equipment	6%	9%	59%	26%
We maximise commercial advantages when procuring travel and accommodation	6%	17%	56%	22%
We ensure continuous supply in the procurement of specialised commodities such as medical equipment	3%	38%	38%	21%
We form partnerships with our strategic suppliers	4%	63%	17%	15%

Table 2 reveals that strategic sourcing practices is to some extent aligned with the organisational annual procurement plan (53% agreement). However, the transactions on the procurement plans are not properly analysed for the purposes of developing sourcing strategies (55% disagreement). The respondents feels strongly that in the sourcing process, the concern is about quality than price (76%). Hence, the sourcing team do not always conduct industry analysis in the sourcing process (an average of 50% for agreement and disagreement). With regards to commodity management, the analysis of the data shows the perspectives with regards to commodity management. The respondents do agree that they have different categories of commodities in different departments (70% agreement); and they conduct needs assessment before procurement of goods and services (70% agreement). The respondents strongly disagreed with the statement that they form partnerships with suppliers in the procurement of strategic commodities.

- **Procurement spend analysis and total cost of ownership (TCO)**

Respondents were asked to indicate on a five-point Likert response format with end points 1 (strongly disagree) and 4 (strongly agree no extent), the extent to which they agree on

statements regarding procurement spend analysis and total cost of ownership. The findings are presented in percentages as reflected in table 3.

Table 3: Perceptions of the respondents with respect to procurement spend analysis and total cost of ownership

Statements	**SD**	**D**	**A**	**SA**
We perform procurement analytics annually	15%	36%	38%	11%
We know how much is spend on designated groups in our database	13%	36%	45%	11%
We keep statistics of spending on different categories of commodities	11%	28%	53%	8%
We have a quantified deviation register	6%	17%	49%	28%
We only consider price for the procurement of goods and services	15%	35%	29%	21%
We consider both direct and indirect costs when procuring goods and services	2%	23%	48%	27%
Our sourcing process takes into consideration TCO	4%	15%	46%	35%

With regards to procurement spend analysis, just above average (51%) of the respondents are in agreement that pprocurement analytics is perform annually. However, they are not sure of how much is spend on the various designated groups in their database (51% disagreement). Also, they do not have statistics of spending trends on the different categories of commodities that is procured (61% disagreement). Furthermore, the respondents did not have quantified deviation register (77% disagreement). This indicate that to a large extend procurement analytics is not well implemented to inform procurement best practices and compliance. For TCO, an average (50% agreement) of respondents indicated that only price is considered for the procurement of goods and services. A third (75% disagreement) of the respondents were of the view that they consider both direct and indirect costs when procuring goods and services. Furthermore, most of the respondents (81% disagreement) disagreed with the statement that their sourcing process takes into consideration total costs of ownership. Based on the results TCO is not well understood and implemented by institutions in the province.

- **Enterprise and supplier development**

Respondents were asked to indicate on a five-point Likert response format with end points 1 (strongly disagree) and 4 (strongly agree no extent), the extent to which they agree on statements regarding enterprise and supplier development. The findings are presented in percentages as reflected in table 4.

Table 4: Perceptions of the respondents on enterprise and supplier development

Statements	**SD**	**D**	**A**	**SA**
We have an ESD strategy in place	33%	39%	25%	2%
Our ESD strategy accommodates changing government regulations	35%	42%	19%	4%
Our ESD strategy has been translated into clear key performance indicators	34%	47%	17%	2%
Our ESD strategy is fully integrated with our sourcing and demand planning processes	32%	46%	18%	4%
Our ESD implementation plan is very clear	39%	39%	19%	4%

We have dedicated resources to implement our ESD strategy	39%	39%	15%	7%
Our ESD outputs are included in management performance contracts	41%	41%	15	4%
Our ESD process is close monitored and reported at Executive Management on a monthly basis	42%	42%	13%	4%
Our procurement plans has opportunities for SMMEs development	6%	21%	30%	43%

Based on the results, enterprise and supplier development initiative in the province is still in an infancy stage. Most of the respondents do not have an enterprise and supplier development strategy in place (72% disagreement) in their departments, municipalities and entities. The respondents do not have have an enterprise implementation plan (78% disagreement) and they do not not have a dedicated resources available for such initiatives (78% disagreement). However, they are opportunities in the procurement plans for SMMEs development (73% agreement). Therefore, the provincial government need to create sensitisation on the strategic importance of enterprise and supplier development towards job creation and upliftment of the living conditions in the province.

- **Supplier performance and contract management**

Respondents were asked to indicate on a five-point Likert response format with end points 1 (strongly disagree) and 4 (strongly agree no extent), the extent to which they agree on statements regarding Supplier performance and contract management. The findings are presented in percentages as reflected in table 5.

Table 5: Perceptions of the respondent about supplier performance management

Statements	**SD**	**D**	**A**	**SA**
Our contract management process is fully document	4%	28%	39%	30%
We utilise standard contract documents issued by National Treasury	0%	9%	58%	33%
We have structured service level agreement in place	2%	7%	60%	31%
We have formal review process in place for all contract	6%	28%	37%	30%
Our suppliers are held accountable for poor performance through contracts	5%	33%	33%	29%
We pay our suppliers within 30 days of invoice	4%	16%	53%	27%
We have periodic meetings with our strategic suppliers	2%	33%	38%	27%

Concerning table 5, the contract management process is to an extent documented (69% agreement). Standard bidding documents issued by the National Treasury are used for all transaction (91% agreement) while there are structured level agreements in place with their suppliers (91% agreement). However, just over half of the respondent felt that suppliers are held responsible for poor performance through contracts (62% agreement). It is interesting to note that suppliers invoices are settled within 30 days (80% agreement) and there are periodic meeting with suppliers (65% agreement). Therefore, the province have created a lot of sensitisation on the strategic importance of supplier performance which may have an effort for good contract management processes.

- **Supply chain management implementation challenges**

Respondents were asked to indicate on a five-point Likert response format with end points 1 (strongly disagree) and 4 (strongly agree no extent), the extent to which they agree on statements regarding SCM implementation challenges. The findings are presented in percentages as reflected in table 6.

Table 6: Perception of the respondents on supply chain challenges

Statements	**SD**	**D**	**A**	**SA**
Our SCM policies and regulations are fragmented	2%	33%	49%	16%
We do not have effective contract management systems	6%	37%	44%	13%
Our SCM objectives are not effectively communicated to staff	4%	36%	42%	19%
There is resistance to change in SCM systems by management	2%	25%	34%	40%
Our SCM planning is poor	2%	15%	34%	40%
We have cases of fraud and corruption reported	4%	17%	65%	13%
There is lack of skilled SCM workforce	0%	8%	72%	21%
There is unwillingness to share information due to lack of trust among SCM members	6%	26%	36%	32%
There is inadequate accountability and control mechanism	10%	31%	50%	10%
There is lack of top management support to the integrative SCM approach	13%	23%	36%	28%

From table 6, the findings revealed that there is fragmentation of supply chain policies and regulations (65% agreement). Just over half of the respondents believe there is poor implementation of contract management systems (57% agreement). Furthermore, 61% are of the view that the respondents feel that supply chain objectives are not effectively communicated. An interesting observation is that there is resistance to change in supply chain systems by top management/leadership (74% agreement). 93% of the respondent are of the view that there is poor procurement planning. The respondents noted that there is unwillingness to share information with to supply chain members due to lack of trust (68% agreement), inadequate accountability and control mechanism systems (60% agreement). In line with table 18, there is lack of top management support to the integrative SCM approach (64% agreement). This results confirms reports of the National Treasury (2015) reviews and also the baseline study conducted by the National Treasury (2016), on the state of implementation of SCM in the country.

4.2 Discussion of the Results

Following the results and analysis, it could be deduce that SCM drives transformation and restructuring to accommodate the previously disadvantage and that SCM contribute towards job creation and the economy. It is also critical for the advancement of socio-economic development in the country. SCM practitioners in province do acknowledge the strategic importance of SCM towards inclusive growth and socio-economic development. However, the implementation to a great extent is a challenge. Strategic sourcing is to some extent aligned with organisational annual procurement plan in the province. However, the sourcing team do not always conduct industry analysis in the sourcing processes as well as lack of strategic partnerships with suppliers in the procurement of strategic commodities. Procurement plans and targets are always not followed and respected. Thus, it has become a paper exercise. Enterprise and supplier development initiative in the province is still in an infancy stage. Most of the departments, municipalities and entities donot have an enterprise and supplier

development strategy in place as well as dedicated resources available for such initiatives. Nevertheless, there are opportunities in the procurement plans for SMMEs development. Furthermore, a lot of sensitisation on the strategic importance of supplier performance has been made as an effort for good contract management processes. In conclusion, some of the challenges identified hindering effective implementation are: fragmentation of supply chain policies and regulations; poor implementation of contract management systems; supply chain objectives are not effectively communicated; poor procurement planning; unwillingness to share information with to supply chain members due to lack of trust, inadequate accountability and control mechanism systems. An interesting observation is that there is resistance to change in supply chain systems by top management/leadership.

Inclusive growth requires the provincial government to break down structural impediments to new economic activities, deconcentrate industries dominated by few participants, and accelerate the inclusion of black designated groups into jobs and businesses. Three pillars of SCM that could accelerate inclusive growth and socio-economic development include:

- ✓ Improve SCM capacity development and professionalisation;
- ✓ Ensure ethics and good governance; and
- ✓ Enforce strategic procurement.

- **Ethics and Good Governance in Procurement**

Good, ethical governance is the key driver of a capable developmental state, and generates sustainable development without compromising the results. Significant capital and human resources have been deployed to enhance the NDP's objectives in the province. The following measures should be put in place to ensure ethics and good governance:

- Enforce laws and regulations to combat corruption
- Put system in place to detect and combat corruption
- Improving governance of public sector SCM through cooperation with stakeholders
- Improving governance of SCM through transparency
- Ensure *accountability by politicians and officials*, particularly the accounting officer and the SCM officials.
- *Promotion of ethical leadership across the provincial leadership.*
- Developing and prescribing a public disclosure framework to govern transparency within the SCM process.

- **Building Supply Chain Capacity and Professionalisation**

The shortage of skills remains one of the top constraints to effective SCM implementation. Following the findings, it is imperative to note that SCM operate at low levels of professionalism and competence, with assigned little organisational status and not seen as a value driver. A mind-set shift is needed so that SCM is located amongst government entities' highly strategic functions to transform and create value through its activities. Key activities to develop, empower competent and committed SCM employees should include:

- Promoting informal and formal workplace learning.
- Promoting workplace coaching and functional mentorship.
- Supporting the development and delivery of education and training programmes.

- **Strategic Procurement**

Procurement has important economic and political implications, and ensuring that the process is economical, efficient and crucial. However, it is often seen as a back office role within the public sector. It is not viewed as strategic by public sector decision makers. Its contribution is unfortunately seen as minimal and transactional. It is viewed purely as a 'number crunching

exercise as opposed to a value-added and strategic business development function, placing it at a rather low position within an organisation (Boateng, 2014). Procurement officials in the province should focus on long term supplier relationship, local economic development in favour of emerging local suppliers. Therefore, improving procurement practices in the province by removing obstacles and boosting the involvement of SMMEs is a key priority for inclusive growth and socio-economic transformation. The provincial government therefore need to identify efficient ways for procurement to realise value for money, create opportunities and promote beneficial change. Table 7 provides a guideline on how the provincial government can accelerate inclusive growth through strategic procurement.

Table 7: Accelerating inclusive growth through strategic procurement

Phases of SCM	**Description**
Demand management	Develop an effective procurement plans
	Develop specific target for different designated groups
	Clearly stipulate sourcing methodology to be used for each procurement.
	Categorise commodities and identify commodity managers/champions.
	Develop a "SMART" specification to cater for: • Local content • Designated groups • Sub-contracting • Enterprise and supplier development • Preference point systems applicable • Allocation & breakdown of BEE points } Drivers of inclusive growth
Acquisition (bid evaluation)	Enforce transformation criteria in the specification during evaluation
Contract and supplier performance	Evaluation of supplier performance in line with transformation criteria

CONCLUSION

Since 2004, SCM has gained significance in the South African public sector. It is being used as an enabling mechanism for the government to implement policy towards socio-economic development and transformation. The paper investigates the extent to which SCM is implemented in accelerating inclusive growth and socio-economic development in a South African provincial government. A survey was conducted among senior SCM managers from provincial government, municipalities as well as provincial entities.

Following analysis and discussion, the findings revealed that SCM practitioners in the province do understand the importance of SCM towards inclusive growth and socio-economic development. However, the maturity of SCM is still in an infancy stage and SCM is not sufficiently used as a strategic function. The report confirms to the views of the SCM (2015) review that SCM is imperfect. The province is challenge with skills, competencies and knowledge of SCM practitioners, non-compliance to policies and regulations, ethical conduct and political interference in achieving the full potential of SCM towards inclusive growth. Therefore, harnessing the potential of SCM requires a major physiological change and

embracing the strategic role within governments. There is also need to re-organise and re-align organisation structures to elevate SCM. The paper concludes with a recommendation on how SCM could be enhanced. Three pillars of SCM were identified as a blueprint to accelerate inclusive growth and socio-economic development in the provincial government: SCM capacity development and professionalisation; ethics and good governance; and strategic procurement.

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The role of manufacturing automation as an enabler of reshoring

Alessandro Ancarani[1], Carmela Di Mauro[2], Francesco Mascali[3]
DICAR, Università di Catania, Viale Doria 6, Catania

Abstract
Building on a data set of over 800 reshoring initiatives in manufacturing, this paper explores the extent to which automation and additive manufacturing have acted as enablers of the relocation of production to high cost countries. The paper further delves into the linkages between offshore challenges, firms' competitive strategies and reshoring enabled by these technologies. Results suggest that the adoption of these technologies is tied to cost-oriented motivations underlying reshoring. Results also highlight distinct patterns for US and European manufacturing companies, in terms of perceived challenges offshore.

Keywords: Automation; Innovation; Reshoring.

Introduction

In recent years, there has been a rising interest in the reshoring of manufacturing (Fratocchi et al., 2014; Foerstl et al., 2016), intended as the relocation back to the country of origin or in its proximity of production processes previously moved to low cost countries.

Operational and strategic challenges that firms face in the offshore locations, causing actual performance to fall short of the expected target, have been pinpointed as being at the root of reshoring (Hartman et al., 2017). These challenges may arise out of an ex ante mistaken evaluation of the expected costs and benefits of offshore production (Bals et al., 2016; Gray et al., 2013; Kinkel and Maloca, 2009), or may reflect ex post changes that require a reassessment of locational advantages (Bals et al., 2016; Fratocchi et al., 2016). In this latter respect, several observers have attributed reshoring to the reduced labor cost differentials between high cost countries (HCCs) and low cost countries (LCCs), and to rising logistics costs (Kinkel, 2014; Simchi-Levi et al., 2012). Others have stressed issues such as unsatisfactory product quality offshore (Ancarani et al., 2015), and the growing need for production flexibility (Kinkel, 2014) and customer responsiveness (Moradlou et al., 2017). Several recent review articles have provided extensive discussions of the main offshore challenges that motivate reshoring (among others, Bals et al., 2016; Di Mauro et al., 2017; Foerstl et al., 2016; Fratocchi et al., 2016).

At the same time that some of the locational advantages of LCCs shrink, new opportunities arise in HCCs, encompassing the higher value attached by customers to "made in" products (Ancarani et al., 2015; Grappi et al., 2015), the lower cost of energy (Simchi-Levi et al., 2012; Tate, 2014), and governmental subsidies for reshoring (Joubioux and Vanpoucke, 2016; Tate, 2014).

Besides these changes in locational advantages, reshoring decisions have been influenced also by market and technological developments. Market factors include growing international competition, increasing market volatility, rising demand for highly customized products, and shortened product life cycles (Wiengarten et al., 2017). As part of the technological developments, automation and digital solutions are increasingly being embraced in manufacturing, driven by advancements and falling costs in digital technology (McAfee et al., 2012; Fitzgerald et al., 2014; Kotter, 2014; Schoenherr and Speier-Pero, 2015).

[1] Alessandro.Ancarani@unict.it
[2] cdimauro@unict.it
[3] fmascali@dica.unict.it

As a matter of fact, several scholars have pinpointed the availability of new technologies as the key enabling factor for reshoring, arguing that the return of traditionally labor intensive productions to HCCs to be economically sustainable only if coupled with the adoption of labor saving technologies. In fact, automation and digitalization improve product manufacturability, reduce time and waste in production processes, and eventually reduce the firms' reliance on labor (Arlbjørn, and Mikkelsen, 2014; Bals et al., 2016; Heikkila et al., 2017). However, current evidence on the extent to which the adoption of new technologies acts as enabler of the return of manufacturing to HCCs is scarce, and there is a similar dearth of conceptual elaboration on which value chains are most likely to be reshored exploiting the potential advantages technology creates. In order to fill this research void, the aim of the present study is threefold:

a) To develop a conceptual framework explaining the likelihood of adoption of advanced production technologies as part of reshoring;
b) To provide empirical evidence on the extent to which reshoring is associated with new technologies;
c) To explore whether reshoring taking advantage of new technologies responds to specific offshore challenges and firms' competitive strategies.

This analysis can shed light on macro aspects of reshoring, by identifying initiatives that we may expect in the near future in terms of sectors involved, firms' size, and country specificities. In this respect, this paper can contribute to inspire policies supporting the return of manufacturing to HCCs (Ketokivi et al., 2017; Spring et al., 2017). Micro level implications can be obtained by gaining understanding on the link between new technology adoption and specific competitive strategies. In this light, the results may inform the reshoring decisions of manufacturing companies.

The paper is organized into the following sections: Section 2 discusses theoretical underpinnings of reshoring initiatives, while Section 3 introduces the expected impacts of automation and additive manufacturing on reshoring. Section 4 elaborates on the types of reshoring strategies, and develops testable hypotheses. The empirical analysis is presented in Section 5. Section 6 provides a discussion of empirical results vis-a-vis our conceptual model, while Section 7 concludes with limitations and future research directions.

Theoretical background

Several theoretical approaches have been applied to the analysis of location decisions (international trade theories, international business, strategic management theories), each highlighting different core factors explaining location choice. Two important theories that can enhance our understanding of reshoring are Transaction Cost Economics (TCE) and Resource based view (RBV) (Foerstl et al., 2016; Fratocchi et al., 2016). In light of these theories, firms make location choices evaluating the efficiency of the control and coordination structures, and searching long-term competitive advantage (McIvor, 2013). Both theories have been applied to evaluate the conditions for disintegrating, mobilizing, or re-integrating specific value chain activities from a geographical point of view.

According to TCE, the rationale for offshoring production activities, especially those involving more manual routine tasks, stems from the fact that they require low monitoring and enforcing costs towards foreign subsidiaries and suppliers, and do not require coordination costs since they are independent from other company functions and stages of the value chain (Mudambi, 2008; Ketokivi et al., 2017). This makes location in LCCs attractive, because of the benefits of low labor costs and economies of scale.

RBV describes firms as bundles of resources that are heterogeneously distributed, with resource differences persisting over time. The selection of which sections of the manufacturing value chain to outsource/offshore should then be undertaken looking at how the decision

impacts upon the long-term capabilities of the organization, in order to avoid that over time key capabilities are relinquished (McIvor, 2013). In this perspective, the relocation of some activities can be considered part of the global disaggregation/aggregation of the value chain, as firms try to combine the comparative advantages of geographic locations with their own resources and competencies, with the goal to maximize their overall competitive advantage (Mudambi and Venzin, 2010). Firms retain control over the components or processes of the value chain through which they can create and appropriate the most value (Jensen et al., 2013), while outsourcing and/or offshoring less value adding activities (Mudambi, 2008).

In the so-called "smile curve" of the value chain (Mudambi, 2008) both TCE and RBV combine to explain the offshoring of manufacturing activities. Production activities are offshored because they are identified as standardized, modular and low value adding activities (Sturgeon, 2002), with respect to value-chain activities at the upstream (e.g., design and R&D) and downstream ends (e.g., marketing and after-sales services), which are more knowledge intensive and require non-replaceable skilled workers that command high wages and allow for market power. Therefore, manufacturing can be offshored to LCCs while upstream and downstream value chain activities are often retained in HCCs.

Reversing the above arguments can contribute to explain reshoring initiatives. A TCE-consistent explanation for the geographical re-concentration of the manufacturing value chain in HCCs implies an increase in coordination and control costs that firms face offshore with respect to the home country. These higher transaction costs may be caused by rising uncertainty, specificity of operations, or frequency of transactions within the value chain (Williamson, 1981). The greater degree of customization, differentiation, and product innovation currently required by many markets (Ashby, 2016; Bailey and De Propris, 2014; Bals et al., 2016) may all conjure to increase the specificity of production activities, therefore requiring a tighter control (through geographical proximity) and greater coordination within the value chain (e.g. between production and R&D). In terms of the shape of the value chain curve, customization, differentiation, and product innovation will translate into a higher value added content of production. This phenomenon, known as product upgrading (Humphrey and Schmitz, 2002), determines a "smirking" rather than a "smiling" value chain curve.

Conversely, in the perspective of RBV, reshoring may follow from the opportunity to exploit competencies geographically held in the home country, such as the competences residing in local industrial clusters (Di Mauro et al., 2017), greater labour skills that lead to higher product quality (Ancarani et al., 2015), or from the more effective protection of intellectual property rights in HCCs with respect to LCCs (Tate et al., 2014; Tate, 2014; Wiesmann et al., 2017).

The extension of RBV to dynamic environments that require fast adaptation of sources of competitive advantage (Dynamic capabilities theory, Teece et al., 1997), may also contribute to explain reshoring. Dynamic Capabilities identify the capacities to "sense" and "shape" opportunities and challenges, to grab opportunities, and to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the firm's resources (Helfat and Peteraf, 2009; Pezeshkan et al., 2016; Teece, 2007). They encompass the capacity for improving quality and managing human resources, and the capacity for utilizing new technologies (Drnevich and Kriauciunas, 2011). In this light, reshoring may be viewed as the outcome of the learning process that builds on the firm's dynamic capabilities, and through which the firm identifies the opportunity to develop a more effective strategy by relocating production back to the home country, reshuffling the firm's resource base, and taking advantage of a geographically shorter value chain.

Advances in manufacturing technologies and reshoring

In recent years, growing international competition, increasing market volatility, demand for highly customized products and shortened product life cycles have created serious challenges

for manufacturing, making it necessary to simultaneously handle demands for cost-efficiency, flexibility, adaptability, and sustainability. In this direction, the rapid technological progress promises to open up a range of new business opportunities (Wollschlaeger et al., 2017), with new paradigms such as digitalization, internet of things (IoT), internet of services (IoS) and cyber-physical systems (CPS). The definition of "Industry 4.0" (Kagermann et al., 2013) identifies a systematic high-tech strategy, encompassing the integration of robotics, 3DP, big data analytics and IoT (Gress and Kalafsky 2015; Hofmann and Rüsch, 2017). These technologies promise to achieve a higher level of operational efficiency and productivity by providing IT-enabled mass customization of manufactured products, and to make the adaptation of the production chain automatic and flexible, by tracking parts and products, and facilitating communication among parts, products, and machines (Lu, 2017; Roblek et al., 2016).

Although robots and digital tools have already been inside companies for many years, what has changed recently is the acceleration of both the capabilities enabled by these tools, as well as the pace of adoption (Schoenherr and Speier-Pero, 2015), determined by the higher maturity of ICT and lower costs of hardware and software (Fraunhofer ISI, 2015). These technological innovations have the potential to create new sources of value for the business, resulting in a dynamic reconfiguration of the firm's resources (Galunic & Eisenhardt, 2001), therefore acting as and engendering appropriate dynamic capabilities.

Scholars have recently supported the idea that automation and, more generally, Industry 4.0 technologies, can be considered enablers of reshoring strategies. In fact, the conventional wisdom that HCCs do not need to manufacture and can simply act as a "hub" for high value added activities can be overturned by using the new generation of automated and digital technologies, which can be considered a great "equalizer" of location costs, as they allow to reduce products' unit cost by means of improved productivity and reduced scraps (Bals et al., 2016). This view is fully embraced by managers of reshoring firms. For example, Monster Moto President declared: *"We can't just blow up our cost structure, the only way to make it work in America is with robotics"*. Along the same lines, the vice president of the Confederation of Danish Industry: *"We can see the same trend in Europe that robots and automation are the driving forces of moving the production home, as they keep the payroll down," (Robotics Business Review, December 29, 2016).* (GeoCache, July 15, 2014).

Other benefits of adopting new technologies *while* relocating to HCCs may stem from the growing demand for customization and differentiation of products, which is making flexible production and shorter value chains advantageous (Simchi-Levi et al., 2012). Variety increases transport and logistics costs, as the production unit has to deliver each product in smaller batches, and to keep extra inventory to account for unforeseen variation in consumer demand across varieties (Zhou and Wan, 2017). In this perspective, technologies allowing for lower costs of flexible production will likely promote reshoring initiatives (Lu, 2017).

Finally, new technologies may drive reshoring also in those instances in which the geographical reintegration of the value chain is important for new product development, prototyping, etc. In these cases, the co-location of production and development may become a source of greater value creation at the manufacturing stage, by exploiting linkages economies (Ketokivi et al., 2017). In particular, technologies such as additive manufacturing may be called both at the development stage to aid prototyping and at the manufacturing stage to curb production costs, therefore becoming effective enablers of reshoring. The following example reports a paradigmatic case of a company benefitting from 3D printing in the development and production stages. Thinklabs, a company producing stethoscopes, outsourced production to China in 2003 but, by fall 2013, the company convinced itself that, with careful design, it could mass-produce stethoscope parts using 3D printing, therefore significantly increasing design and production flexibility.

To sum up, advanced and additive manufacturing technologies may provide strong incentives for reshoring when they contribute to reduce the benefits of extreme specialization and enhance flexibility, and when they are adopted within production-development coupled processes.

Model development

Building on the discussion of the previous two sections, in this section we propose a conceptual model that identifies three possible strategies underlying the reshoring of offshore production (Fig. 1). Following the manufacturing strategy literature (Parthasarthy and Sethi, 1993), we identify a pure quality-oriented strategy, a pure cost and efficiency driven strategy, and a flexibility-oriented strategy. The first two reshoring/strategy types are also related with the two main generic competitive strategies, oriented either to value/differentiation or to cost/efficiency (Wheelwright, 1978; Porter, 1980), while the third path is defined as a hybrid strategy as it aims at competing in the market based on product/volume mix and product innovation in a cost effective manner (Parthasarty and Sethi, 1993). We argue that the likelihood of adoption of advanced and additive technologies as part of the reshoring initiative differs according to the competitive strategy. The rationale is that strategy types are directly related to manufacturing competencies and that, especially under conditions of evolving manufacturing technology (such as Industry 4.0), a fit between manufacturing competences and the firm's competitive strategy is required in order for performance improvement to accrue (Parthasarthy and Sethi, 1993).

The starting point of the analysis is the assumption that the pre-reshoring value chain reflects a "smile curve" model (left hand side of Figure 1), whereby manufacturing was located offshore because it was considered low value adding, while R&D and marketing generally remained in HCCs (Mudambi, 2008).

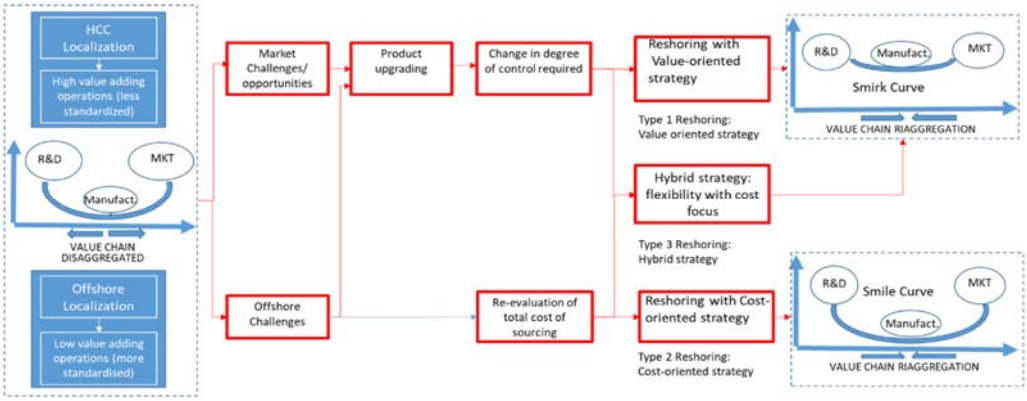


Figure 1 – Reshoring paths and predicted adoption of new manufacturing technologies

Type 1 – Smirking reshoring (Value/Differentiation strategy). It is relocation that concerns those value chains for which the company senses the opportunity for shifting for product upgrading, and from a cost-oriented competitive strategy to a quality/value-focused one (Bals et al., 2016; Di Mauro et al., 2017; Robinson and Hsieh, 2016). The product upgrading may follow from increasing competitive pressures in global markets and falling margins for standardized products, in response to which firms increase the knowledge content of their production activities, either by moving into more sophisticated product lines (Humphrey and Schmitz, 2002) and/or by moving into niches that have entry barriers and are protected to some extent from these pressures (Gereffi, 1999). As a result, value added becomes more equally distributed along the value chain, and the "smile curve" of value added flattens to become a "smirk" (Rehnberg and Ponte, 2017).

The creation of greater value at the production stage may also engender the need for cross-functional information exchange and collaboration. In this light, reshoring may represent the rational solution to the needs of the company to co-locate R&D, prototyping and production, in order to take advantage of linkages economies (Di Mauro et al., 2017; Ketokivi et al., 2017; Mudambi, 2008) and to reduce coordination and control costs. Finally, the firm may benefit from the shift from a global to a local/regional supply chain, because of customers', brand recognition through the "made in" effect (Ancarani et al., 2015; Grappi et al., 2015).

Building on previous empirical findings on the links between a differentiation strategy and automation of manufacturing (e.g. Zahra and Covin, 1993), we contend that the value-oriented reshoring strategy is not significantly associated with new technology adoption. The main reason is that firms for which product upgrading engenders a significant premium price may have weak incentives to seek efficiency and cost-containment through the new technologies. In addition, in line with RBV, in sectors such as clothing and the fashion industry, which are heavily involved in reshoring initiatives (Ancarani et al., 2015; Ashby, 2016), the value generated by highly specialized human capital by far exceeds the return that could be generated by capital investment in new technologies. Thus, it is hypothesized:

H1 – Reshoring led by a value-oriented strategy is not significantly associated with the adoption of automation and additive manufacturing technologies.

While capital investment and adoption of the latest technology may be independent of the firm's competitive strategy, automated processes and technologies such as additive manufacturing have the capability to significantly improve product development and producibility decisions (Garrido-Vega et al., 2015; Parthasarthy and Sethi, 1992). For instance, 3D printing supports customization and quick responsiveness to fast-changing consumer preferences and market conditions (Laplume et al., 2016). Therefore, additive manufacturing augments the benefits of the geographical reintegration of the value chain, being an essential requirement for fast prototyping (Garrido-Vega et al., 2015; Rehnberg and Ponte, 2017). Thus, when the reshored value-oriented production involves new product development, the adoption of advanced technologies such as 3D printing becomes likely, because of the complementarity between product and process innovation (Piening and Salge, 2015).

The above discussion leads to the following moderation hypothesis:

H2 – Reshoring led by a value-oriented strategy is positively associated with the adoption of automation and additive manufacturing technologies if it is coupled with new product development.

Type 2 – Smiling reshoring (cost-oriented strategy). In value chains with a cost leadership focus, firms relocate in HCCs as a response to changed conditions offshore that affect costs. Consistent with TCE, reshoring may follow from challenges such as the reduced gap in input costs between locations, increases in transport costs, and realization of the high costs of coordinating and monitoring distant operations and relationships (Manning, 2014).

For standardized and commoditized products, the cost/efficiency focus implies that the production stage of the value chain continues to be low value adding. Therefore, the shape of the value chain curve remains consistent with the "smiling curve" model. In this instances, labor saving technologies such as automation/robotization represent necessary pre-requisites for maintaining competitiveness following reshoring, since they act as equalizers of production costs between HCCs and LCCs (Dess and Davis, 1984; Zahra and Covin, 1993).

The above discussion leads to the formulation of this hypothesis:

H3 – Reshoring led by a cost/efficiency-focused strategy is positively associated with the adoption of automation and additive manufacturing technologies.

Type 3 – Smiling/smirking reshoring. Companies may also compete based on product variety and customization provided in a cost effective manner (Garrido-Vega et al., 2015; Parthasarthy and Sethi, 1993; Tracey et al., 1999; Tu et al., 2001). In particular, in mass customized markets differentiation and the emphasis on cost controls coexist, resulting in a "hybrid" or "dual" strategy (Kotha and Swamidass, 2000; Parthasarthy and Sethi, 1992, 1993). This strategy relies on production flexibility, and benefits from customer proximity that allows customization at point of delivery (Da Silveira et al., 2000). Therefore, for those firms whose markets are located in HCCs, reshoring can support a flexibility strategy through customer proximity, allowing companies to postpone final design and manufacturing decisions (Yang et al., 2004), and increasing the ability to be fully responsive to market demand.

In the past twenty years, advanced manufacturing techniques have made the cost-variety trade-off less stringent, as proven by the experience of companies in several sectors (Kotha and Swamidass, 2000; Fogliatto et al., 2012). In this direction, Salvador et al. (2009) proposed that among the tools available for making mass customization effective is the adoption of flexible automation. However, early analyses of the impact of automation argued that the willingness to pay a premium price for customized products largely depends on the higher performance quality of the product (Chakravarty and Kumar, 2002). In turn, this quality is assured by a dynamic network of relatively autonomous operating units, requiring multi-skilled employees who can develop new capabilities through learning processes. When firms try to implement mass customization relying on automation, the result is to weaken the skills of the workers and to reduce learning opportunities (Pine, 1993). Peng et al. (2011) empirically confirm this view, showing that manufacturing IT has an insignificant impact on the capability to successfully implement mass customization.

The above discussion leads to the following hypothesis:

H4 – Reshoring led by hybrid strategies is not significantly associated with the adoption of automation and additive manufacturing technologies.

There have been many studies linking flexibility with different types of innovation in the extant literature (Oke, 2007). It has been argued that while manufacturing plants can become flexible, without having to be innovative, flexibility is a necessary ingredient for innovation (Bolwijn and Kumpe, 1990). In the same direction, Slack et al. (2010) report that in order to satisfy customers' needs for new products, an operation must have a high degree of flexibility. Indeed, the flexibility of the machinery coupled with high labor skills enables new product ideas to be quickly developed to achieve product innovations (Oke, 2013).

Therefore, we hypothesize that:

H5 – Reshoring led by hybrid strategies is positively related with the adoption of automation and additive manufacturing technologies if it is coupled with product innovation.

In any of the three reshoring modes identified, the potential benefits linked to the adoption of new technologies for product innovation have been emphasized. Further, Millson et al. (1992) report that several well-known advanced manufacturing and design automation processes may be employed to accelerate product innovation. In particular, information technology can affect product development speed in a remarkable way (DeFosse and Barr, 1992). Menon et al. (2002) proved that the adoption of new manufacturing technologies speed-up product innovation and time-to-market. In accordance with the literature, we propose the following:

H6 – Reshoring led by the need for product innovation is positively related with the adoption of automation and additive manufacturing technologies.

Figure 2 summarizes the hypothesized model, in which reshoring leveraging on new technologies is depicted as a response to specific strategies of the company affecting the shape of its value chain. The adoption of new technologies is also affected by the product innovation necessary for the companies to be competitive in the market. Beside its direct influence, product innovation plays also a role as moderator of the impact of the strategies.

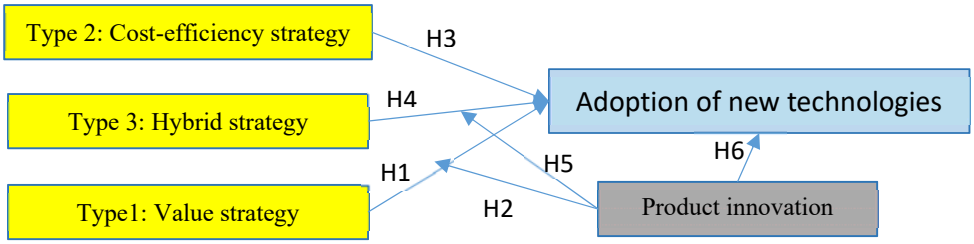


Figure 2 - Hypothesized model

Empirical analysis

Sample characteristics

In order to test our model, we created a database of 842 reshoring cases, obtained from secondary sources (press sources, press releases by the companies involved, companies' websites, and white papers from consulting companies). Secondary data have been used both in International Business and Operations Management research (Benedettini et al., 2015; Judd et al., 1991; Roth et al., 2008, Yang et al., 2006). Written records such as newspapers and magazines are considered useful when no other sources are available (Cowton, 1998, Franzosi, 1987, Mazzola and Perrone, 2013). This might be the case for reshoring, since the unit of analysis is often the product or component (rather than the firm), and therefore public secondary data are difficult – if not impossible – to obtain (Gray et al., 2013).

The database was created by merging information from the UniClub More Reshoring, a private database including data collected by a consortium of Italian universities and reporting reshoring moves of companies from all over the world from 2009 up to early 2016 (Fratocchi et al., 2016); from the Eurofound Monitor of Reshoring (https://reshoring.eurofound.europa.eu/), a public database reporting reshoring moves of European firms from 2014 to mid-2017; and from ReshoreNow.org, a public database of reshoring moves of US-based firms up to the end of 2016. The existing data bases were used to identify the cases of reshoring and the original sources of information. In order to build a homogeneous database, the research team re-examined the original sources and checked all the information required for the purpose of the present analysis. The available sources were evaluated by two members of the research team separately, and then compared in order to avoid misinterpretation of the text (Kolbe and Burnett, 1991). In case of different positions, a third researcher was involved, and the source was reviewed again until agreement was reached (Jacobson et al., 2012). In addition, when multiple sources were available, the information was compared and, in case of inconsistencies, the case was eliminated from the database. The unit of analysis was the single reshoring initiative, thus allowing for more than one initiative for each company, in case of reshoring of production from different host countries. The database provides information on firm's size, manufacturing sector, home country and offshore country, year of offshoring and reshoring, governance mode both offshore and inshore, and main motivations for reshoring. Whenever possible, companies' motivations for reshoring were inferred from the quotation of direct interviews with the companies' managers, as reported in the source. The coding of motivations applied for the purpose of the study was the one used by

the Eurofound Reshoring Monitor, which comprises 43 motivations inductively obtained from the literature on reshoring (https://reshoring.eurofound.europa.eu/methodology).

The sample includes small (24%), medium (23%), and large firms (53%). Most cases reflect a stability of governance modes offshore and inshore. In particular, insourcing both offshore and inshore represent 56% of cases, while outsourcing applies to 20% of the sample. The reshoring motivations most frequently cited by managers and deemed to be consistent with a value strategy are "Improve production quality" (22%), "Relevance of Made-in for customers" (18%), and "Protection of Intellectual Property Rights (IPRs)" (5%). Frequent reshoring motivations consistent with cost-focused strategies are "Increased logistics costs" (21%), "Change in total cost of sourcing" (20%), "Decreased gap in labor costs" (15%), "Cost of control of offshore subsidiaries/suppliers" (8%), and "Cost of delays and long delivery times" (19%). Reshoring motivations consistent with hybrid strategies include "Need for customer proximity" (19%) and "Production flexibility" (9%). Almost half of the reshoring moves are from China (49%). Production returns to USA (46%), Italy (15%), UK (10%), Germany (6%), France (6%), other European countries (Austria, Belgium, Denmark, Finland, Norway, Spain, etc.) (14%), and other countries in the world (3%). This makes the proportion of reshoring decisions in our sample balanced between USA and Europe.

Out of the total number of reshoring cases, 186 (22%) declare that innovation was involved in the relocation. Of these, 154 adopted process innovation, including 109 explicitly citing automation and additive manufacturing and 45 firms declaring other typologies of manufacturing process innovation (e.g. lean, six sigma). Support for the reliability of our sample stems from comparison with results of the survey carried out by the Boston Consulting Group in 2016 on manufacturing companies in Europe and the US. This survey shows that actual adoption of Industry 4.0 is still very low (19% in Germany and 16% in the US) and in line with the diffusion highlighted in our sample (13%).

Empirical modelling

In order to test the model described in Figure 2, we apply a binary logit model in which the dependent variable is the adoption of automation and additive manufacturing technologies by the manufacturing company following reshoring. In the measurement model described in Figure 3, we proxy manufacturing strategies by means of reshoring motivations. In turn, since motivations reflect perceived challenges and opportunities, we assume that strategic goals drive the perception of what constitutes a challenge offshore or an opportunity onshore, since challenges/opportunities are perceived as such only when they meet the firm's strategic goals and performance objectives, due to bounded rationality (Manning, 2014; Ocasio, 1997).

The adoption of value strategies (H1) is captured by the following motivations for reshoring: need to improve quality of production, "made in" effect, and need to better protect intellectual property rights. Cost-focused reshoring strategies (H3) are associated with the following challenges offshore: reduction of labor costs gap, increasing logistic costs, increased total costs of sourcing, complexity of coordination of offshore production, cost of delays in deliveries. Hybrid strategies (H4) are pinpointed by need for customer proximity, and need for greater production flexibility. The model also explores the association of new manufacturing technologies with new product development, as captured by a binary independent variable for product innovation (H6), and by its interactions with value-oriented motivations (H2) and with hybrid strategies motivations (H5).

Control variables include industry related variables (captured by dummy variables for three sectors typically involved in automation/robotization, namely automotive, electronics and mechanics), the degree of control (proxied by the governance mode following reshoring, whether insourcing or outsourcing), the offshore host country (China), the size of the reshoring firms (whether the firm is an SME), and the technological maturity reached (captured by the

normalized reshoring year). Finally, we control for other home-country-specific factors, such as the presence of external support for reshoring, either public (public incentives) or private (e.g. preferential contracts offered to reshoring suppliers by buyers for "made-in" products", as done by Walmart in the US).

In order to take into account potential differences between the industry structures in US and Europe (Ancarani et al., 2015), we estimated the logit model separately for firms whose headquarters are located in Europe (n = 429) and in the US (n = 388).

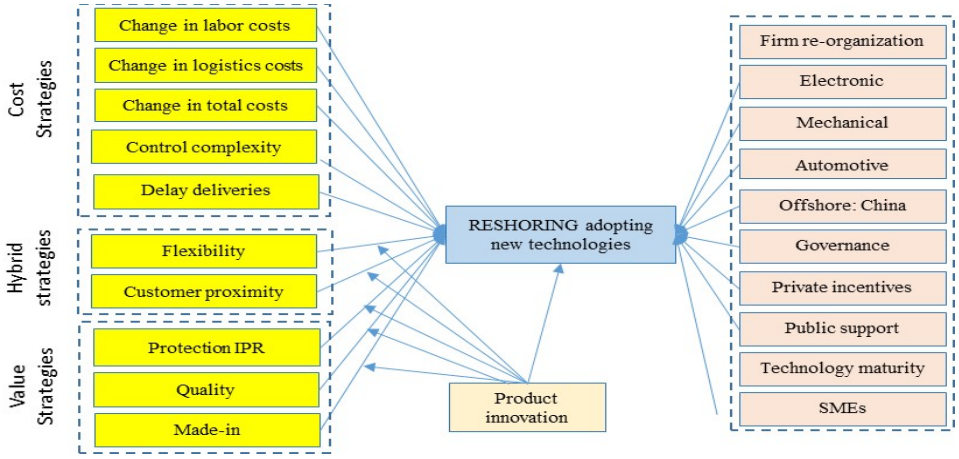


Figure 3 – Measurement model

Results

Table 1 reports results for each subsample (Europe and US). Model 1 includes level variables but no interactions with product innovation, while Model 2 includes interaction terms.

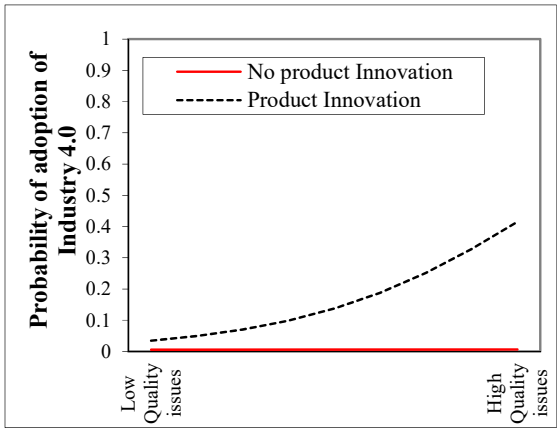
Consistent with hypothesis H1, none of the value-oriented motivations is significantly related with new technologies, both in the EU and in the US. Similarly, motivations related to a flexible strategy (i.e. production flexibility and customer proximity) are never significant, thus failing to support H4. Cost-related motivations are generally significant both in Europe and the US, albeit with differences in terms of specific significant variables. Therefore, results lend support to H3. Results from the European sample show that the complexity of controlling offshore activities, as well as costs stemming from delayed delivery are positive and significant. Increased logistic costs are significant but negatively related to the adoption of new technologies. In the US, control complexity and the increase in the total costs of sourcing are significantly related with the adoption of Industry 4,0. In Model 2, interactions terms with product innovation are statistically significant for the variable relating to quality of the offshore production in the European sample, and for customer proximity in the US sample. In order to assess the overall impact of quality and customer proximity we use the graphical moderation analysis introduced by Aitken and West (1991) (Figure 4). The left hand side of Figure 5 (a) lends support to H2, given that the adoption of Industry 4.0 when the firm adopts a quality oriented strategy is enhanced by product innovation in the EU sample. Conversely, in the US subsample when reshoring is motivated by the need to increase customer proximity, product innovation negatively moderates the adoption of Industry 4.0, therefore leading to reject H5. Product innovation is always significant and positively related to Industry 4.0, Therefore, H6 is confirmed. Turning to the control variables, the likelihood of new technology adoption following reshoring is never significantly associated with the industrial sector, with the offshore host country, or with the firm's size. No relation emerges with respect to public incentives, while private incentives from buyers are positively and significantly related to new technology adoption for the US. The European sample presents a significant but negative coefficient for

firm's global reorganization. Finally, technological maturity, as captured by the recency of reshoring, and the degree of control (insourcing of production) required positively and significantly affect the adoption of new technologies in the EU.

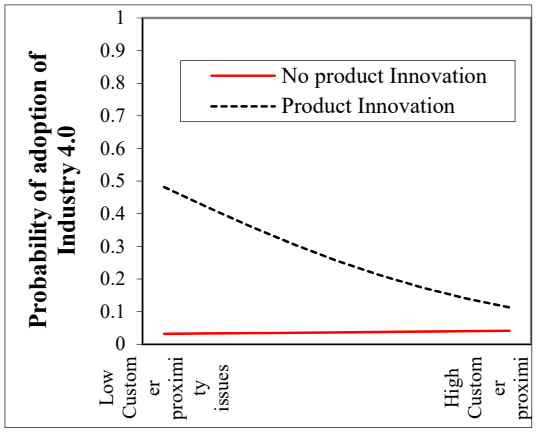
Table 1 – Logistic regression (dependent variable: adoption of Industry 4.0)

NEW TECHNOLOGY ADOPTION	WORLD						EU						US					
	MODEL 1			MODEL 2			MODEL 1			MODEL 2			MODEL 1			MODEL 2		
Ind.Vbl	Coeff	St.err	Sig.	Coeff	St.err	Sig.	Coeff	St.err	Sig.	Coeff	St.err	Sig.	Coeff	St.err	Sig.	Coeff	St.err	Sig.
Automotive	0.420	0.345		0.350	0.357		-0.952	0.734		-0.851	0.744		0.960	0.497	*	0.964	0.522	*
Electronic	0.350	0.341		0.459	0.345		0.569	0.588		0.671	0.609		0.128	0.466		0.502	0.486	
Mechanical	0.190	0.317		0.316	0.323		0.388	0.530		0.562	0.558		0.071	0.471		0.302	0.485	
China	-0.326	0.261		-0.387	0.268		-0.589	0.464		-0.941	0.502	*	-0.109	0.380		-0.167	0.388	
Government support	-0.299	0.357		-0.276	0.368		0.407	0.711		0.384	0.753		-0.463	0.511		-0.333	0.538	
Incentives	1.593	0.400	***	1.557	0.409	***	-0.686	1.426		0.037	1.332		2.031	0.479	***	2.056	0.508	***
Reshoring Mode	0.758	0.333	**	0.909	0.350	***	1.894	0.745	**	2.227	0.829	***	0.273	0.418		0.534	0.440	
Reshoring Year	0.557	0.147	***	0.519	0.150	***	1.237	0.267	***	1.243	0.275	***	-0.084	0.196		-0.196	0.193	
SMEs	0.085	0.247		0.103	0.252		0.349	0.413		0.324	0.427		-0.139	0.362		-0.014	0.374	
Product Innovation	1.593	0.301	***	2.425	0.470	***	2.131	0.575	***	2.575	0.820	***	1.596	0.425	***	2.768	0.724	***
Made-in	-0.019	0.301		0.065	0.345		0.138	0.526		0.561	0.603		-0.383	0.438		-0.647	0.518	
Quality	0.583	0.263	**	0.454	0.302		0.692	0.465		0.201	0.547		0.546	0.380		0.583	0.432	
Protection IPRs	0.567	0.512		1.364	0.582	**	(omitted)			(omitted)			0.744	0.578		1.199	0.638	*
Complexity Control	1.229	0.337	***	1.293	0.346	***	2.493	0.773	***	2.783	0.820	***	0.807	0.416	*	0.893	0.438	**
Customer Proximity	-0.320	0.290		0.084	0.326		-0.749	0.540		-0.624	0.597		-0.256	0.423		0.340	0.470	
Logistics Costs	-0.284	0.324		-0.303	0.327		-2.506	0.946	***	-2.498	0.951	***	0.192	0.397		0.300	0.407	
Labor Costs	-0.282	0.363		-0.236	0.370		0.636	0.685		0.692	0.709		-0.707	0.484		-0.847	0.518	
Change Total Costs	0.760	0.262	***	0.792	0.268	***	0.250	0.517		0.294	0.550		1.140	0.358	***	1.203	0.373	***
Delivery Time	0.298	0.288		0.400	0.296		1.107	0.478	**	1.548	0.542	***	-0.526	0.440		-0.432	0.449	
Flexibility	0.268	0.366		0.667	0.406		0.738	0.569		0.667	0.622		0.384	0.581		1.002	0.664	
Firms Reorganization	-0.662	0.395	*	-0.567	0.404		-1.300	0.610	**	-1.525	0.670	**	-0.299	0.654		-0.224	0.689	
Qual*ProdInn				0.452	0.661					3.559	1.542	**				-0.495	0.933	
Madein*ProdInn				-0.334	0.723					-1.678	1.302					0.876	1.109	
IPR*ProdInn				-1.957	1.127	*				(omitted)						-2.020	1.367	
Custom*ProdInn				-1.618	0.680	**				-1.448	1.254					-2.869	1.119	**
Flex*ProdInn				-1.455	0.829	*				-1.300	1.839					-1.492	1.293	
Constant	-3.352	0.413	***	-3.689	0.443	***	-4.741	0.846	***	-5.148	0.944	***	-2.746	0.557	***	-3.348	0.620	***
R-square	0.1835			0.2079			0.3535			0.3805			0.1937			0.2277		
No. Obs	832			832			415			415			380			380		

*** p < 0.01, ** p<0.05, * p<0.10



a) "Quality" moderated by product innovation in the EU sample



b) "Customer proximity" moderated by product innovation in the US sample

Figure 4 – Moderation analysis

Discussion

This paper has developed a conceptual framework explaining the likelihood of adoption of new technologies as part of reshoring. Based on the tenet that manufacturing technologies must be aligned to the competitive strategy (Parthasathi and Sethi, 1992), we have elaborated on the expected association of new technology adoption by reshoring firms with cost-oriented strategies vs. value-driven strategies.

Our model posits that the majority of relocations to HCCs are purposeful and strategy-driven (Benito, 2015; Fratocchi et al., 2016). Although other scholars have attributed reshoring to mistaken offshore decisions (Bals et al., 2016; Kinkel and Maloca, 2009), only few companies reshore within a short time span (Ancarani et al., 2015), while more often, firms point to challenges arising in the offshore location due to changes in locational advantages (Manning, 2014) or to growth opportunities envisaged in the home markets (Di Mauro et al., 2017). Our model posits that for cost-oriented firms, automation and additive manufacturing technologies may represent a necessary ingredient of relocations to HCCs, because of the need to "equalize" production costs with LCCs' locations (Bals et al., 2016). On the other hand, rising demand for product differentiation has led many companies that had relocated production offshore to repatriate at least their high end segments (Ashby, 2016), or to upgrade their products (Humphrey and Schmitz, 2002) in order to generate higher value for the customer, leveraging either on the "Made in" label (Grappi et al., 2015), or on linkages economies within the value chain (Mudambi, 2008). Our model posits that for competitive strategies aiming at a premium price, technologies such robotization and additive manufacturing are not necessarily associated with reshoring, except in those cases in which reshoring is tied to product innovation. In this instance, new technologies may become an essential component of cost-effective prototyping and product development.

The other aims of the paper were to provide empirical evidence on the extent to which reshoring initiatives are associated with new technologies, and to test our conceptual model. Our sample, based on a heterogeneous set of firms with headquarters mainly in Europe and the US, shows that the diffusion of advanced and additive manufacturing among reshoring companies is still low (13%). Although we have already pinpointed that this figure is roughly in line with what has emerged from recent surveys on manufacturing companies (Boston Consulting Group, 2016), the adoption of these technologies does not appear to be crucial for reshoring yet. Consistent with RBV, dynamic capabilities need to be activated, as reshoring companies need to reshuffle their resource base in order to acquire skills related to the new technologies. However, data suggest that the adoption is on the rise and, especially for European companies,

adoption is higher for companies that have reshored recently. Of interest is also the finding that robotization and 3D printing are the only instances of Industry 4.0 technologies that are cited by the reshoring firms, while IoT and big data exploitation are never mentioned. This finding suggests that reshoring firms are drawn towards labor- and time-saving technologies, rather than towards the possibility of intra- and cross-firm integration.

Model testing lends support to the importance of the company's strategy, as proxied by motivations for reshoring (Manning, 2014; Ocasio, 1997). Both in Europe and in US, motivations linked to value strategies (Made in, Quality, Protection of IPR) are not significantly associated to new technology adoption. Given that about 40% of the reshoring cases report at least one value-oriented motivation, this result implies that there is a significant portion of reshoring for which labor-saving and flexibility advantages offered by these technologies are not – at least for the moment being, a necessary pre-requisite for repatriation. This value-oriented reshoring is partly driven by resource-based considerations, such as the search for supplier competences and labor skills in HCCs (McIvor, 2013) that do not engender the reconfiguration of the technological base. However, product upgrading, as signaled by the quality focus, is related with additive and advanced manufacturing adoption when it involves product innovation. This finding suggests that new technologies enables product-development coupling, by supporting timely prototyping and product design (Ketokivi et al., 2017).

Cost related motivations are significantly related to new technology adoption, consistent with the idea that these technologies support cost containment and productivity, therefore representing an effective equalizer between costs in HCCs and LCCs. This result suggests that, as knowledge and competences about these technologies become widespread, more cost-focused firms should embrace reshoring.

Mass customization, as signaled by the search for production flexibility and customer proximity, is not tied to reshoring. Contrary to our expectations, reshoring motivated by customer proximity does not promote the use of new technologies even when reshoring firms undertake product innovation. This finding may reflect the fact that relocation close to customers, i.e. the product-market coupling discussed by Ketokivi et al., 2017, may simply reflect the firm's need for better understanding the market and for benefitting from postponement, and may not require technology advancement, except in the form of digitalization of production and sales data. Hence, results indicate that product-development coupling enhances the need for the new manufacturing technologies, while production-market coupling does not.

While the conceptual model is confirmed, differences can be found between the two subsamples in terms of significant variables. In both samples, control complexity of offshore activities is significantly related to the adoption of new technologies. Costs stemming from the complexity of controlling offshore operations reflect both the mere geographical distance between the manufacturing offshore location and the other firm's activities (Handley and Benton, 2013), and the cultural distance between headquarters and LCC's production. According to TCE, control complexity will give rise to higher costs of monitoring and enforcement of plans/contracts and of coordination among units or buyer and supplier. In such a case, geographical re-concentration allows cutting these costs, while automation of production contributes to make total costs inshore level with those offshore.

For US firms, rising total costs of sourcing offshore are significantly related to reshoring through new technology adoption, suggesting that the closing gap between production costs in LCCs and HCC is further reduced through technologies enhancing productivity and quality control. New technology adoption is relevant for EU companies that reshored because of delivery delays problems. These companies had mostly offshored to Asia, and have adopted an insourcing governance mode following reshoring, possibly with the aim to combine cost cutting with tighter control of production and delivery times. Reshoring due to rising logistic costs is

negatively associated with the adoption of new technologies in Europe. This finding may indicate that reshoring per se solves the challenge of high logistic costs and does not require any additional investment in cost-saving technologies.

Contextual factors point to further differences between the two geographical areas. Of notice is the fact that automation for EU firms is associated with a reshoring insourcing mode, pointing to vertical integration as a strategy to overcome monitoring and control issues. In addition, the technological update is significantly associated with a global reorganization of production facilities, often exploiting untapped production capacity at home generated by the economic crisis. For the US, a significant role is played by corporate customers that have decided to increase their share of "made in America" suppliers (such as Walmart), pushing these suppliers to reconfigure their overall set of resources in order to remain competitive.

Conclusions and Limitations

Are advanced and additive manufacturing technologies going to support the return of manufacturing to high cost countries? And if so, which companies are more likely to use it as an enabler of their back-relocation? These questions, which are at the forefront of current academic and policy debate, have not received an empirically grounded answer so far. This paper has sought to provide at least a partial answer, by associating the adoption of new technologies not only to structural characteristics of reshoring companies (industry, size) but above all to firms' manufacturing strategies and challenges experienced offshore.

While results lend support to our conceptual model of the link between cost vs. value strategies and technology adoption, some limitations must be highlighted. First, the relatively low number of firms implementing advanced and additive manufacturing technologies has not allowed to study the linkages between reshoring models and specific components of the new paradigm (e.g. robotization vs. 3DP). Next, although careful textual search has been applied in order to extract information from our secondary sources, first hand data on firms' strategies, experienced challenges, and value chains should be used to complement and enrich our information.

As the adoption of new technologies progresses, future empirical research will be called to provide an in-depth assessment of whether the adoption of technologies related to Industry 4.0 will contribute to reshoring initiatives and to their success.

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Environmental considerations when purchasing transport services: A Comparison between Swedish and French Shippers

Dan Andersson
Chalmers University of Technology
Department of Technology Management and Economics
S-412 96 Gothenburg, Sweden
dan.andersson@chalmers.se

Nathalie Touratier-Muller
University of Pau and Pays de l'Adour (UPPA),
CREG- Management Research Center
64000 Pau, France
nathalie.touratier-muller@univ-pau.fr

Environmental considerations when purchasing transport services: A Comparison between Swedish and French Shippers

Abstract

This paper explores transport purchasing among companies in Sweden and France. The purpose is to analyse shippers' transport purchasing behaviours, e.g the provider and mode selection criteria. Based on available data from a Swedish survey and a qualitative study conducted in France, this paper identifies similarities and differences between the shippers' perceptions and actions in these two geographical and cultural contexts. This research makes major academic contributions comparing transport solution selection criteria within European countries, collecting at the same time rich data bases on shipper's behaviours regarding their providers' environmental practices.

Keywords Transport purchasing behaviour; provider selection criteria

Working paper

Introduction

The Transport sector, which represents almost a quarter of Europe's greenhouse gas emissions (GHG), generates many debates, studies and discussions regarding how to decrease this impact. The problem has been addressed by a high-level group at the UN and the 23rd session of the Conference of the Parties (COP 23) included a "transport thematic day", highlighting the urgent need to reduce carbon emissions, which could be accomplished by a mix of policies and governmental measures. The majority of greenhouse gas emissions from transport is caused by CO2 emissions (Piecyk and McKinnon, 2010), and within Europe, in 2015, road transport accounted for over three-quarters (75.3%) of the total inland freight transport[1].

Initiatives to reduce the negative impact from transport can be observed in many countries, which primarily try to decrease CO2 emissions. Within Europe, France and Sweden are examples of quite proactive countries, while different in nature. France sets the objective to reduce the CO2 emissions from transport sector by 29% from 2015 to 2028[2] whereas Sweden has as an objective to reduce emissions from domestic transport by at least 70 per cent by 2030 compared with 2010[3]. According to Mahmoudi et al., (2017), Swedish freight initiatives have a great potential to lower road freight CO2 emissions. On its side, France has introduced various transport initiatives, for instance: carriers, who voluntarily adhere to a specific charter of commitments (*Charte Objectif CO2*) since 2008, can obtain compliance certification after 3 years if achieving a high environmental performance. In response to this measure, a new voluntary charter has been settled for shippers (*Charte FRET 21*). It has been under experiment by 10 pro-active shippers since May 2015 and should be open to 1000 other French companies until 2020 (Touratier-Muller and Jaussaud, 2017). In a different register, since October 2013 a mandatory scheme (decree n°2011-1336) obliges all French carriers to calculate and inform their customers about their CO2 impacts.

Although the European Union has prioritised the reduction of CO2 emissions from transport, practices and behaviours influencing this tendency, such as how freight transport is purchased

[1] Accessed on February 5th 2018: Freight transport statistics - modal split: http://ec.europa.eu/eurostat/statistics explained/ index.php /Freight_transport_statistics_-_modal_split

2 Accessed on February 5th 2018: Ministère de la Transition Ecologique et Solidaire, observations et statistiques: https://www.ecologique-solidaire.gouv.fr/programme-objectif-co2

[3] Accessed on February 11th 2018 : Goverment offices of Sweden, 2017: http://www.government.se/articles/2017/06/the-climate-policy-framework/

have been scarcely explored, and even less been compared between countries. Scrutinizing how shippers (i.e. transport purchasers who own the goods) select their transport providers (suppliers in charge of the transportation service) could provide insights which could facilitate development of appropriate environmental national or European freight transportation measures.

There are some national studies that have highlighted how sustainable development can better be taken into account during the transportation procurement process, for instance in Sweden (Rogerson et al., 2014), in Germany (Large et al., 2013) and in France (Touratier-Muller et al., 2017). However, to our knowledge, there is no literature analysing and comparing transport procurement practices between European countries. Such studies may generate knowledge and provide support when developing sustainable European policies. Consequently, as a first step, the purpose of this paper is to shed light on transportation purchasing process in two different European countries. The starting point will be Sweden and France, which both could be considered as progressive with respect to their ambitions to curb the negative consequences of transport emissions. In order to find comparable and interesting transport buyers in each country it was decided to focus only on transport buyers for which the environmental aspects of transport are of very high importance.
This research provides an overview of the features of transportation purchasing practices, and highlighting some specificities inherent to each country context. Our goal is not to test or generate theory but to use some industrial purchasing concepts of the IMP group (Cova and Salle (1992), to investigate the buying purchasing process in both countries.

This paper is organised as follows. A literature review provides the starting point for the work and the formulation of three research questions. The following section presents the methodology, and thereafter the main results are presented and discussed. A final section presents the conclusions and future research.

Literature review

Academic studies based on the road freight sector provides a broad spectrum of information. This literature review focused on two main areas: (1) shippers' incidence to adopt sustainable transportation, (2) shippers 'perspective when purchasing transportation services.

Patterns and characteristics incidence

While cultural values seem to shape certain processes within supply chains (Walker et al., 2008), the work of Thornton et al., (2013) reveal that socially responsible supplier selection is more encouraged and rewarded in developed countries. Other surveys conducted specifically in the transportation purchasing process in Sweden (Pålsson and Kovács, 2014) highlight the company cultural weight to retain environmental criteria. Although the culture of the shipper seems to play a key role, however, no work has been found scrutinizing these cultural differences according to country specificities.
Size of the company has no incidence according to Björklund (2011) whereas Lammgård (2012), Pålsson and Kovács, (2014) find a correlation showing that the bigger the company, the more proactive it is to integrate environmental issues. In line with these findings, Rogerson (2016) and Van den Berg and Wan De Langen (2016) underline that larger companies are more inclined to implement green transport practices than small companies. It could be explained by the willingness of large companies to pay for environmental improvements, whereas small companies' priorities are more focused on costs (Lammgård, 2012).
Industrial sectors also seem to exert a substantial influence, "*customers from the industry sector are considered to have fewer and lower green requirements than customers from the food*

industries" (Isaksson, 2012 : p.47). Industrial sectors involving direct consumer products seem to induce more detailed green demands than other services such as transportation. Product characteristics (Björklund, 2011) as well as material flow characteristics (Rogerson, 2012) also seem to exert an influence to green the transportation flows. These different findings lead to formulate the first research question:

RQ1. Are there any specific patterns among proactive shippers, willing to consider sustainability when purchasing transportation services?

Shippers' perspective when purchasing transportation services

The purchase of services that include logistic services as well as transport requisitions, are intangible by nature. As a consequence, the selection process is far different from the purchase of goods as it is underlined by Jackson et al., (1995). In order to explore shipper's perspective regarding the transportation purchasing process, the core elements of the ARA model, established by IMP researchers could be used (Cova and Salle, 1992; Håkansson and Snehota, 1995; Håkansson et al., 2009). This relies on three main network components which are: (1) the actors (involved in the business interaction), (2) the resources (physical, financial, human and technical assets) and (3) the activities. Each of these three elements play an important role in the analysis of the network. Furthermore, Håkansson's (1982) interaction model determines a fundamental framework to explain the specificity of Business to Business (BtoB) relationships. According to him, it is described by "*stability rather than change*", "*long-term relationship rather than short-term business transactions*" and by "*closeness rather than distance*" (p. 6). Furthermore, the relationships between buying and selling firms have the stability which derives from the length of the relationship.

This theoretical pillar attracts our attention for two reasons: not only does it allow to observe how companies, according to its resources and its sector activity interact with other companies (external interactions), but it also explores internal interactions among firms' functions.

Bardi (1973) seems to be one of the first authors that tries to identify the key factors determining the carrier selection. This author identifies five factors of influence: transit time reliability, transportation rates, total transit time, willingness to negotiate, and financial stability. More recent studies confirmed that service quality (Govindan et al., 2013; Rogerson, Andersson, and Johansson, 2014) and cost (Lammgård and Andersson, 2014; Rogerson, 2016) remain the two most important criteria when selecting a carrier. In this perspective, carrier's environmental performance is frequently cited but is still not a selection criterion (Large et al., 2013; Gonvindan et al., 2013). However, Björklund and Forslund (2013) noticed that companies that include environmental performance in transport contracts do not necessarily consider how to measure the environmental performance and how to handle non-compliance. In this perspective, Evangelista (2014) adds that the lack of a standard methodology for environmental performance measurement prevents companies from sharing the costs and benefits of environmental initiatives. As a consequence, in line with these findings, we could formulate the second and third research question:

RQ2. What are the selected criteria prioritized during the transportation tender process?
RQ3. How is the transportation purchasing organised?

Methodology

The purpose of this pre-study is to compare transport purchasing practices, especially concerning environmental aspects, and thereby it was deemed appropriate to use

environmentally concerned shippers in two progressive European countries. In France ten companies, being committed to a voluntary environmental program called FRET 21, were selected. In Sweden the companies stating the highest level of importance of environmental factors when selecting a transport solution were chosen (and this turned out to be 10 firms) out a random sample of (151) companies who had answered a very comprehensive survey about transport purchasing and environmental issues. This survey is part of the work of the Swedish Transport Procurement Panel (Andersson et al., 2016). The data from the two countries were collected at the same time but uncoordinated since these data collection efforts were part of previously designed projects which later were identified as partly similar and offering potentials for comparisons between countries. In both countries cases studies and qualitative data collection have been used but data used from the Swedish companies that were identified as most environmentally concerned is in this paper limited to survey data. The data from France is the result from a case-based methodology, providing rich descriptions and allowing examination of numerous factors and nuances (Boyer and Swink 2008). In total data about the transport purchasing has been collected from proactive shippers: 10 companies in Sweden and 10 companies in France.

Sample selection in France and Sweden

Companies in France			
Industrial Sector	**Size**	**Country of origin**	**Respondent**
Petrochemical	Large	American	Supply Chain Manager
Mass distribution	Large	French	Sustainable Supply Chain and Transportation Manager
Food industry	Large	American	Sustainable Supply Chain Manager
Food industry	Large	Italian	Transportation Purchasing Manager
Food industry	Large	French	Transportation Purchasing Manager
Food industry	Medium	French	Transportation Purchasing Manager
Chemical	Medium-	French	Transportation Purchasing Manager
Hygiene	Large	Swedish	Supply Chain Director
Building materials	Large	French	Supply Chain Director, and 2 Transportation Buyers
Automotive	Large	French	Environment Supply Chain Director

Table 1: List of the French shippers interviewed

Companies in Sweden			
Industrial sector	**Size**	**Country of origin**	**Respondent**
Manufacturing	Medium	Sweden	Warehouse manager
Paper product manufacturing	Large	Sweden	Transport manager
Mechanical industry	Large	Japan	Strategic purchaser
Wholesale	Medium	Sweden	Transport manager
Packaging material	Large	Sweden	Purchasing manager
Manufacturing	Medium	Sweden	Strategic purchaser
Wholesale equipment	Medium	Sweden	Logistics manager
Manufacturing of equipment	Large	USA	Purchasing manger
Food manufacturing	Medium	Sweden	Logistics manager
Chemicals	Large	Sweden	Transport coordinator

Table 2: List of the Swedish shippers

The 20 companies included in the pre-study provide a field study group showing geographical diversity, diversity in size and industrial sector. These characteristics are presented on a high level in table 1 and 2, and due to reasons of confidentiality, details and names of companies cannot be shown.

An interview guide was developed by the French researcher regarding various categories that include: (1) Motivations and resources to develop sustainable transportation procurement, (2)

Purchasing process and environmental sensitiveness, (3) CO2 information utilization as well as (4) Environmental collaborations between shippers and carriers. The Swedish survey instrument included similar questions divided into 34 main categories of with several sub-questions. These questions were answered in writing online, including both closed and open answer alternatives. All the respondents were selected based on their responsibilities to buy transportation services. Each interview with the French shippers was fully recorded, transcribed and codified by the researchers. This method of typing and organising handwritten field notes offers a great opportunity to obtain verbatim transcriptions (Patton, 2002).

Data analysis

The coding process consisted of reading, analysing and underlining key sentences from the French interviews. The Swedish data was coded when entered by the respondents in the online survey, however, there were also answers in the free text format. A cross case analysis offers a way to group together answers from different respondents to similar questions (Patton, 2002, p. 440). This process allowed researchers to centralise and synthesise key answers to our research questions. Researchers from Sweden and France put their data together and selected questions which were common in both studies. Similarities and differences in both countries were identified and analysed.

Findings and discussions

French and Swedish Shippers 'characteristics incidence' to integrate sustainability in their transportation purchasing process

Comparing table 1 and table 2, we can notice that, although shippers' countries of origin are diversified, the parent company coming from developed countries. This first results, in line with Pålsson and Kovács (2014) suggestion that cultural weight of developed countries seem to exert an influence to commit companies to integrate sustainability in their purchasing process. This observation ties up with the idea that socially responsible supplier selection might be more encouraged and rewarded in developed countries, as it had been suggested by Thornton et al., (2013). This cultural patterns can constitute the "Atmosphere", underlined by the ARA model, wich is translated as

Concerning the size, there is no link between proactivity and size, however, small companies were not included in the Swedish sample. There may be a difference compared with the result of Rogerson (2016) and Van den Berg and Wan De Langen (2016) results, highlighting that larger companies are more inclined to implement green transport practices than small companies. However, there is nothing in our result that contradicts this claim.

Moreover, as we can see in Table 2, industries sectors from proactive French and Swedish shippers are diversified: food industry, chemical industry, hygiene sector, building materials, petrochemicals, automotive, paper, mechanical mfg etc. Consequently there is no industrial sector in particular which seems to emerge more than another, which is also supported by an analysis of the entire Swedish random sample.

According to the IMP model, some characteristics impact the actor interactions such as social systems in particular countries that *"surround a particular industry or market*" (Håkansson, 1982 : p.29). Since the country of origins of the proactive companies come from developed countries, we could interpret that it constitutes a pattern to consider sustainability when purchasing transportation services whereas size of the company or industrial sector do not seem particularly relevant. These first findings, provide part of the answer to the research question 1, although larger-scale analysis would be needed to confirm these results.

Transportation criteria retained by 20 proactive shippers in France and Sweden

We explored and compare the transportation selection criteria among these 20 proactive companies in both countries (Table 3).

		French Shippers interviewed										Swedish Shippers responding									
		F1	*F2*	*F3*	*F4*	*F5*	*F6*	*F7*	*F8*	*F9*	*F10*	*S1*	*S2*	*S3*	*S4*	*S5*	*S6*	*S7*	*S8*	*S9*	*S10*
Transport criteria	Price	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	Punctuality/quality of service	●		●	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●
	Safety	●						●													
	Environmental			●		●	●	●		●		●	●	●	●	●	●	●	●	●	●
	Good collaboration in the past		●			●						●			●		●	●	●	●	●
	Certification, ISO											●	●	●	●	●	●	●	●	●	●

Table 3: Some of the criteria used when selecting carrier/transport provider

From the French side the primary selection criterion is the price for half of the companies interviewed. Nevertheless, the other half of French shippers mentioned that the service quality (punctuality; reactivity, truck availability) and the safety of the vehicles (especially for transportation of dangerous materials) remain the primary criterion. Despite the fact that these 10 proactive French shippers are committed to a voluntary program to reduce their transportation impact, none of them stressed the environmental criteria in their decision process. Four of them took into account carriers' environmental performance, awarding points regarding their fleet of vehicles, their fuel consumption, their truck standards, truck consumption, or their engagement to sign a voluntary carriers charter of commitment (*Charte Volontaire CO2*) launched by the French government in 2008. They also add value on environmental proposals from carriers that use lighter trucks and to those who set up financial-benefit sharing, as well as fronthauling/ backhauling practices. Nonetheless, although environmental awareness is raising, these elements as well as certifications or ISO standards do not occupy a weight yet in the decision process.

From the Swedish side, all of the 10 proactive shippers had high marks on most of the provider selection criteria in table 3. However, none of the companies stress the previous experiences very much and three of them, 2,3 and 5 gave this criterion very low scores. In addition, one of them, S10 did not view price as important at all instead this company stated an array of service aspects, such as punctuality and reliability, as the most highly rated, and the environment was more important than cost. All of the other nine companies stated environment as the most or second most important provider selection criterion. There were no explicit questions about safety and it is not possible to make any statement about this.

All the paragraphs above regarding the selected criteria answers research question 2.

In both countries, awarding innovative initiatives are rather prioritized since a solution "at the same price, but less polluting" is favoured. In this way, Swedish shippers highlight their efforts to select the most environmentally friendly solution "if it works from a service point of view and is not too expensive."

Regarding findings by Björklund and Forslund (2013) and Evanglista (2014) who highlighted the lack of a standard methodology for environmental performance measurement performance, we notice that French government introduced various programs to assess carriers' environmental performance. The decree 2011-1336 which has to be respected by all French carriers could be a selection criterion for example. However, French shippers attitudes regarding decree 2011-1336 is insignificant. Surprisingly, French shippers value more when carriers are involved in voluntary programs. They do not give any weight at all regarding the fact that carriers obey or not to the law, respecting the decree 2011-1336.

Transportation purchasing organisation

In addition to transport selection criteria, the organisation of the transport purchasing will be scrutinized. In this perspective, comparisons are used to indicate which department inside the company participate to the choice of the transport provider. The contract length as well as the call for tenders or the purchasing of transport are also examined.

		French Shippers interviewed										Swedish Shippers									
		F1	*F2*	*F3*	*F4*	*F5*	*F6*	*F7*	*F8*	*F9*	*F10*	*S1*	*S2*	*S3*	*S4*	*S5*	*S6*	*S7*	*S8*	*S9*	*S10*
Department participating to the choice of the carrier (F) or mode (S)	Supply Chain	●	●	●	●	●	●	●		●	●	●	●	●	●				●	●	●
	Purchasing	●	●	●				●	●		●										
Contract length	Years	*5*	*1*	*1*	*0*	*0*	*1*	*0*	*3*	*3*	*2*	*2*	*3*	*2*	*2*	*2*	*2*	*3*	*3*	*3*	*2*
Centralisation of the transport tender process/purchasing	Central	●	●	●	●	●		●	●	●	●			●	●		●		●	●	●
	Local						●					●	●		●	●	●	●			●

Table 4: Transportation purchasing organisation characteristics

Comparing results in both countries, it can observed that the purchasing department play a key role among the French proactive shippers whereas it is not prominent among the 10 environmentally focused Swedish shippers. However, this is not the answer to the same question, The Swedish companies responded to a question about which department (or other external organisation, as in case 5-7) that made the transport mode selection. In general the purchasing department is also involved in the transport purchasing in Sweden. The results highlight that the transportation tender process in France is rather handled by two departments (Purchasing and Supply Chain), whereas in Sweden several different departments (grouped into the category Supply Chain) supervise this task. However, the final decision in both countries is mainly made by units that can be categorised into to the supply chain department.

Regarding the ARA model, Håkansson and Snehota (1995) have highlighted how competencies, relationships as well as resources transform dyadic relationships and networks. From this ARA lens, we could then observe that the choice of the carrier in France require competencies and resources from two departments inside de company (the Purchasing and the Supply Chain departments)

Whereas all transportation contracts among the 10 Swedish shippers are signed for 2 or 3 years, a wide variety of responses is observed among French shippers. Six of them do not mention any length in the contracts at all or sign a "1 year contract". We could interpret these results as a search for a very low level of dependency. It could also be an operational strategy that fix and regulates the price for one whole year. The 4 French shippers remaining have contracts that last 2,3 or 5 years. But even if S5 had a contract for 2 years, S7 and S8 3 years all these shippers had a more than 10 year long relationship with their services providers handling the largest contract, and for S9 the relationship had been ongoing for 30 years

The IMP model, which explains the specificity of BtoB characteristics through long-term relationships (Håkansson's, 1982) do not seem to be reflected unanimously among these French shippers. Although they specify orally that they want to work on a long term relationship with their carriers, their organisational process highlight that they do not want to be confined into a contractual relationship. Analysing calls for tenders, we notice that contracts in France are mainly signed at a central level. In Sweden the ten companies focusing on environmental are buying a larger part of the total transport volume centrally 44% (to be compared with 23% for companies not focusing on environment) even if most of the volume in all cases is bought by the local unit 52% (72%). In two of the cases (S3 and S9) 100% of the transport volume was bought centrally.

The elements described above, focusing on the transportation purchasing organisation, respond to research question 3.

Conclusions

The need to achieve environmental sustainability within the transport is getting increasing attention and changes related to purchasing process is acknowledged as one way to contribute to cut CO2 emissions from transport. Although environmental sustainability is gaining recognition, strength and has an incentive impact during the tender process, it does not constitute a decisive criterion to select a carrier.

Both studies conducted in Sweden and France underline similar characteristics regarding the selection criteria. However the Swedish shippers put more emphasis on the carrier's ISO certification, in comparison to French Shippers. Although the French shippers are environmentally proactive, they do not evaluate if the carriers respect the legislation (decree 2011-1336) or any ISO norm. Instead they appreciate if carriers are committed to a voluntary program, such as the CO2 voluntary charter, even though it does not constitute a selection criterion. The proactive companies from both countries see price as an important selection criterion. However, environmental concerns are more influential to the carrier selection for the Swedish shippers than for the French shippers.

From a purchasing organizational perspective, our results highlight differences between the countries. The choice of the carrier in France is handled by the Purchasing and the Supply Chain departments, whereas the Purchasing department is not involved in the mode selection for the proactive Swedish shippers. Furthermore, the length of the transportation contracts highlights significant differences between the countries, with French shippers being more reluctant to sign contracts for more than 1 year. However, these results cannot be generalized. In order to do this other studies should be conducted in a coordinated way at a larger scale.

In both countries, awarding innovative initiatives are being appreciated since a solution "*at the same price, but less polluting"* is favoured. A Swedish shipper made the following comment on their efforts to select the most environmentally friendly solution: *"if it works from a service point of view and is not too expensive."*

There is a need to encourage changes in purchasing practices, which could be facilitated through environmental rules and adapted regulations. The French regulation, through the decree 2011-1336 did not have a real impact so far as it has been demonstrated in our results. A common European legislation using simple tools to measure carriers 'environmental performance could be relevant for all shippers. In addition to legislation, purchasing decisions may also be influenced by cost effects, customer demands and organizational factors. In this particular study, we have noticed both similarities and differences between France and Sweden but it is currently not clear if this is due to context or sampling of respondents.

As a consequence, a need for further research, in both countries as well as in other areas is most certainly needed to develop these initial results. Further research efforts are also needed to investigate the impacts of mandatory and voluntary initiatives to decrease road freight CO2 emissions as well as motivation factors to green the transportation procurement process. This is indeed relevant to better understand how the allocation of sustainable concerns can be taken into account by shippers in order to stimulate progressively supply chain partners to improve their environmental performance. This study confined to two countries presents some other limitations. The main one relates to the small amount of case companies investigated. In order to achieve an empirical generalization, it would be relevant to use same questions and methodology while increasing the number respondents. Furthermore, another limitation relates to the focus on large and medium-sized companies. It would be consistent to investigate shippers' behaviour among small companies.

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PUBLIC PROCUREMENT AND SCHOOL FURNITURE IN BRAZIL

Leomir Ferreira de Araujo
Luiz Ricardo Cavalcante

ABSTRACT

In this paper, we analyze the public procurement as an public policy to improve the performance of the furniture industry in Brazil, which a sector dominated by suppliers (PAVITT, 1984). In particular, we analyze the impacts of the National Price Register (NPR) on the performance indicators of the Brazilian school furniture industry between 2009 and 2015. The analysis is based upon secondary data and semi-structured interviews with suppliers of NPR. We show that these NPR promoted: reduction of uncertainties; standardization of production; and gains of scale and, as a result, process innovations; acquisition of better machinery; and labor force qualification.

KEY-WORDS: Public procurement; low-technology industries.

1 INTRODUCTION

Public procurement has been widely recognized as an instrument for innovation and, more broadly, for industrial performance. Specially in European countries and in the United States, Public Procurement for Innovation (PPI), as it has been addressed in the international literature over the last twenty years, a relevant capacity of fostering the development of high-technology industries such as aircraft production, defense industry, public health (including the pharmaceutical industry), environmental ("green procurement") and energy (KALVET; LEMBER, 2011).

In Brazil, PPI has achieved some positive results in agencies related to energy, telecommunications, pharmaceutical and science and technology sectors (RAUEN, 2017, p. 23). However, public procurement is still little used in the National Innovation System (BONACELLI; FOSS, 2016). In fact, most purchases are related to traditional sectors. That may be a consequence of the reduced presence of high-technology industries in the Brazilian economy and of limitations imposed by the local legislation concerning public procurement. In the country, public procurement obligation is published at Brazilian Federal Constitution, which stablishes the means by which the public administration will secure the necessary contracts with third parties (article 37, item XXI). The General Procurement Law (Law nº 8.666/1993) states that public managers, when picking suppliers, must take into consideration not only the most advantageous proposal, but also the competition between potencial suppliers and the sustainable national development (Article 3 of Law nº 8.666/1993). However, in order to avoid opportunistic behavior, this Law creates obstacles to the adoption of public procurement models focused on innovation. As a result, public procurement in Brazil is more used in traditional sectors such as construction industry (contractors).

In the specific case of education, the National Fund for the Development of Education (FNDE, in its acronym in Portuguese) improved the public procurement instruments based on the so-called "Price Registration System" (PRS, article 15 of Law nº 8.666/1993). The aim of PRS is to elaborate specifications and market studies and to manage price registration (FGV, 2014). The PRS uses the National Price Register (NPR) to establish conditions for public procurement of school furniture in Brazil. Basically, NPR is a public procurement instrument

aimed at providing equipaments and furnitures to attend Brazilian schools . Created by the FNDE, it is structured on the basis of a shared management model which involves, besides the federal government, States and Municipalities. Each entity has a counterpart: submit requirements, appoint responsible agents and rendering of accounts of the values received from the FNDE, when applicable.

However, the impacts of these public procurement policies on the performance of the suppliers have not yet been studied. In fact, PPI is usually associated to high-technology industries such as the aircraft production and the defense industry, but there may be impacts also in low-technology sectors such as school furniture, for example. There is a reduced literature that analyzes the impacts of public procurement on the performance of more traditional segments. The hypothesis proposes NPR such as procurement policies works as coordination mechanism that promotes process innovation, permits the acquisition of better machinery creates incentives for labor force qualification and, as a result, has a positive effect on the performance of the Brazilian school furniture industry.

Thus, in this paper, we analyze the use of public procurement as an industrial policy tool to improve the performance of the school furniture industry in Brazil, which a sector dominated by suppliers (PAVITT, 1984). In particular, we analyze the impacts of NPR on the performance indicators of the Brazilian school furniture industry between 2009 and 2015. Besides this introduction, this paper is structured in four additional sections. In section 2, we summarize the literature on PPI and discuss the technological intensity and patterns of technical change of industrial sectors. In section 3, we describe the methodological procedures adopted in this paper. Results are discussed in section four and the main conclusions are highlighted in section 5.

2 LITERATURE REVIEW

According to Edquist and Hommen (1998), there are two possible designs for government procurement: simple government procurement (standardized products) and innovative procurement (production not yet available at the time of application).

As for the objectives and functions of public innovation purchases, the literature has motivated different possibilities:

- Market expansion (EDLER et al, 2014);
- Promotion of industrial innovation (BORRÁS; EDQUIST, 2013; EDLER et al, 2015);
- Economies of scale to establish the technology market and consolidate the market and technological specifications for standardization of productsof criteria (FRAUNHOFER, 2005); and
- Supplying of public services in the areas of sustainability or energy efficiency (DALPÉ, 1994; TAB, 2006; ASCHHOFF, B; SOFKA, W. 2009; BORRÁS; EDQUIST, 2013, page 22).

Kalvet et al (2013, p.4) provide a framework. For these authors, there are four functions for the use of acquisitions as a vehicle for innovation: *i)* industrial policy; *ii)* R&D policy; *iii)* to meet generic demands; and *iv)* market self-determination policy.

Edler et al. (2015) suggest that the implementation of public procurement policies may be segmented as follows: *i)* identification of a need or challenge; *ii)* transformation of demand into specifications; *iii)* submission of technical specifications to potential suppliers; *iv)*

execution of contracting processes; *v)* product development; *vi)* evaluation of bids; and *vii)* contracts (EDLER et al., 2015).

Some authors argue that this instrument deserves some degree of adaptation and "customization", according to the characteristics of the industrial sectors (BORRÁS, EDQUIST, 2013, p.77). Functional requirements are expected to be developed by the government, so long as production is left to industry (ROTHWELL; ZEGVELD, 1981; GEROSKI, 1990; EDLER; GEORGHIOU, 2007; ASCHHOFF; SOFKA, 2009).

In Valovirta's paper (2015, pp. 71-80), the main requeriments developed by the public innovation procurement policy in the industrial sector are the following: *i)* integration with organizational innovation goals; *ii)* identification of social challenges; *iii)* search for alternative solutions with the support of industry maturity; *iv)* interaction with potential suppliers; *v)* organization of performance tests on the best solutions of the suppliers; *vi)* promotion to the implementation of risk management; and *vii)* quality of the firms of each sector achieved.

On the other hand, the main barriers to the implementation of PPI found in the literature are:

- The low levels of R&D research and the lack of demand for certain innovative products (BORRÁS; EDQUIST, 2013; EDLER et al., 2015);
- The inherent risk aversion of the public sector (ROLFSTAM, 2013);
- The precarious risk management during the purchase process (EDLER et al, 2014, page 631);
- Bureaucratic procurement processes (OGC, 2004; HOUSE OF LORDS, 2011); and
- The information asymmetry (MEERVELD; NAUTA; WHYLES, 2015, pp. 112-113).

Among the risks mentioned above, the lack of experience in innovative purchases by public managers is the most frequent obstacle presented in the literature (EDLER et al, 2014; EDLERet al., 2015; VALOVIRTA, 2015). Besides, Vonortas (2015, pp. 175-176) refers to extensive judicialization, specification dangers, inclusion of industry in political decision-making, flexibilization of contracts.

With regard to the alternatives pointed out in the literature, it is clear that the interaction between the investments involved and the updating of the firms participating in the purchasing policies are fundamental to the success of the innovation processes, especially in relation to product specifications (ROTHWELL; ZEGVELD, 1981; GEROSKI, 1990; EDLER et al, 2014; VONORTAS, 2015; MEERVELD; NAUTA; WHYLES, 2015; BONACELLI; FOSS, 2016). Nevertheless, companies need guarantees of demand and flexibility in the procurement processes to achieve the state of the art for the benefit of society. (EDLER et al, 2015). Most analyses and case studies mentioned so far focus on the use of PPI in high technology industries. According to the Organization for Economic Co-operation and Development (OECD) classification of manufacturing industries based on R&D intensities, these industries involve, for example, aircraft and spacecraft and office, accounting and computing machinery, as shown in box 1.

Box 1: OECD classification of manufacturing industries based on R&D intensities

High-technology	Aircraft and spacecraft Pharmaceuticals Office, accounting and computing machinery Radio, TV and communications equipment Medical, precision and optical instruments
Medium-high-technology	Electrical machinery and apparatus, n.e.c. Motor vehicles, trailers and semi-trailers Chemicals excluding pharmaceuticals Railroad equipment and transport equipment, n.e.c. Machinery and equipment, n.e.c.
Medium-low-technology	Building and repairing of ships and boats Rubber and plastics products Coke, refined petroleum products and nuclear fuel Other non-metallic mineral products Basic metals and fabricated metal products
Low-technology	Manufacturing, n.e.c.; Recycling Wood, pulp, paper, paper products, printing and publishing Food products, beverages and tobacco Textiles, textile products, leather and footwear

Source: OECD (2011).

The use of Pavitt's (1984) taxonomy leads to a similar conclusion. In this case, the manufacturing industry is segmented in four blocks according to their sectoral patterns of technical change: *i)* supplier-dominated (technical change introduced by machinery and raw material suppliers; example include agriculture, housing, private services and traditional manufacture); *ii)* scale intensive (increasing division of labor, project engineering and production as technological support, tending towards incremental innovations, such as bulk materials like steel and glass and assembly like consumer durables and autos); *iii)* specialized suppliers (dynamic companies which focus on product innovations and are mainly associated with the diffusion of the technical progress, like machinery and instruments); and *iv)* science based (R&D intensive; cooperation of universities and research centers, include industries such as electronics and electrical and chemicals). Originally published in 1984, Pavitt's taxonomy was updated by Bell and Pavitt (1993) to include information intensive activities. It is quite clear that PPI usually targets specialized suppliers and science based firms.

On the other hand, it is quite clear that furniture industry is typical low-technology supplier dominated industry, as it fit the characteristics of the traditional manufacture. Technical change in these firms is strongly associated with innovations that take place in the supplier industries (both machinery and raw materials). Supplier dominated firms are generally smaller (than other scale intensive firms) and have weak in-house R&D and engineering capabilities. According to Pavitt (1984), these firms "appropriate less on the basis of a technological advantage, than of professional skills, aesthetic design, trademarks and advertising".

In fact, innovation in the furniture industry comes from suppliers of equipment, machinery and raw materials (quality of sheet size, for example), as reported in the Brazilian Innovation Survey (PINTEC) published by the Brazilian Institute of Geography and Statistics (IBGE).

The manufacture of furniture is a traditional industrial activity, which used inputs of natural origin. Firms are typically labor intensive and present low technological dynamism (BNDES, 2013). In this sense, the Brazilian furniture sector presents low productivity, due to aspects such as investments in physical capital and intangible assets. These characteristics are in line with the dynamics discussed in this section (BATTISTELLA; NEGRINI; WITTMANN, 2007, p. 135). Impacts of innovations are perceived, to a great extent, as the quality of the products and as the fulfillment of export criteria (FREITAS; SILVA; SOUSA, 2012). These authors also point out that barriers to innovating in the furniture industry are motivated by norms, laws and uncertainties of demand. However, to some extent, in some occasions, there are barriers to entry due to economies of scale (BARROSO; CORREA; LEMOS; ROSA, 2007).

As we shown in the remaining of this paper, public procurement – though not explicitly aimed at promoting innovation – can affect the performance indicators of the furniture industry because it affects a series of aspects related to productivity. These aspects involve *i)* reduction of market uncertainties; *ii)* standardization of production; and *iii)* gains of scale) which, in turn, lead to *i)* process innovations; *ii)* acquisition of better machinery; and *iii)* labor force qualification, which may justify a better performance of firms (as measured by labor productivity). As a result, we argue that simple government procurement focusing on standardized products (as described by Edquist and Hommen, 1998) can improve the performance of traditional low-technology and supplier dominated industries (such as the school furniture industry in Brazil).

3 METHODOLOGY

As stated in the introduction of this paper, we intend to analyze the impacts of the NPR on the performance indicators of the school furniture industry in Brazil between 2009 and 2015. In order to analyze these impacts of public policies on firm performance, it is recommended to compare data on the treatment group (i.e., the group of firms that had access to the policy instrument) and the control group (i.e., a group of similar firms except by the fact that these firms have not had access to the policy instrument).

In the specific case analyzed in this paper, we compared average indicators of labor productivity of the furniture industry with average indicators of the firms at NPR group in the period between 2009 and 2015. Labor productivity was measured as the ratio between industrial value added (IVA) and number of employees (NE). We collected data on these variables from IBGE (PIA), in the case of the control group, and from SIGARPWEB, in the case of the treatment.

However, the direct comparison of descriptive statistics of the treatment and of the control group does not face causality issues. In other words: even if indicators of firms at NPR are higher, we cannot be sure whether NPR is the cause of that. There might be a selection bias (i.e., the firms capable of supplying to the government and as such at NPR could be the firms with better indicators). Some statistical methods do cope with this difficulty. Propensity score matching (PSM) methods, for example, can deal with selection bias. However, these methods require microdata which were not available.

Thus, to cope with causality issues, we used i) documental analysis (analysis of laws, for example); and ii) semi-structured interviews with strategic and operational agents of suppliers and potential NPR suppliers. These interviews focused on representatives of NPR participating companies (15 in total) in all editions, from May 2017 to June 2017..

Basically, we assumed transmission channels between public procurement and promotion to performance of low technology sectors. In the case of NPR and the performance of the school furniture industry in Brazil, the transmission channels may work as follows:

- The NPR regulation patterns would stablish product standards and quality control requirements. This aspect is considered a requirement for the success of public procurement policies for innovation in Valorvita's theory (2015, pp. 71-80).

- The design of the public procurement policy would generate possible gains in scale and reduce uncertainties, according to the perception of potential participants, This phenomenon would occur due to the level of adhesionto the proposal by the federated entities, identification of the size of lots by region and level of information about the process.

- Complementarily, the time of the processes for the acquisition of products to the education would behave better than the national average that is of six months (BARBOSA; DEZOLT, 2016). These factors would influence the reality of the business environment provided to RPN suppliers in the context of public procurement in Brazil.

This framework of analysis along with data extracted from SIGARPWEB (product prices and demanded quantity, by edition was used to guide the interviews and as a set of hypothesis to be tested during the interviews. Thus, we analyzed the occurrence of possible gains in scale and reduction of uncertainties, according to the perception of the potential participants about transparency process, symmetry of information, reduced time to electronic trade.

4 RESULTS

Based upon the methodological procedures described in the previous section, in this section we analyze the impacts of the NPR on the performance indicators of the Brazilian school furniture industry between 2009 and 2015.

Table 1 shows data regarding the average of NPR suppliers (treatment group) and the Brazilian furniture industry (control group). In the case of the control group, we considered only the firms with 5 or more employees in order to eliminate smaller firms which would not be capable of being NPR suppliers. Data concerning NPR suppliers are available each two year, so that we considered 2009, 2011, 2013 and 2015. In order to compare labor productivity (LP), we collected data on the industrial value added (IVA) and on the number of employees (NE) for both groups in 2009 and in 2015.

Table 1: industrial value added, number of employees and labor productivity, NPR suppliers and Brazilian furniture industry, 2009 – 2015

	2009	2015	Variation (%)	Standard Deviation (2015)
NPR's IVA aver. (R$ 1000)	10820.38	62673.54	479.22	45095,72
NPR's NE aver.	85	160	88.24	90,46
NPR's LP (R$ 1000/employee)	127.30	391.71	207.71	146,52

Sector's IVA aver. (R$ 1000)	20182252	15895104	-21.24	n.a.
Sector's NE aver.	229.051	260.839	13.88	n.a.
Sector's LP (R$ 1000/employee)	88.11	60.94	-30.84	n.a.

Source: Brazilian Industrial Survey issued by the Brazilian Institute for Geography and Statistics (IBGE) / SIGARPWEB. Elaborated by the authors.

As shown in table 1, labor productivity of NPR suppliers is higher than the furniture industry average labor productivity. In fact, in 2009, the NPR's LP indicator (127.30) was 44,47% higher than Sector's LP registered (88.11). In 2015 the difference between NPR's LP indicator and Sector's LP grew to 542,80%. Besides, between 2009 and 2015, the growth rate of labor productivity of NPR suppliers was 207.71%, whereas the growth rate of the furniture industry labor productivity was 30.84%.

Although causal relationships may be questioned, the magnitude of the difference suggests that NPR firms outperform the industry average. However, considering the impossibility of performing the econometric causality tests, we turn back to the transmission channels described in section 3 to verify the hypothesis of this work.

The project elaborated by the Foundation for the Development of Education of the State of São Paulo (FDE-SP)is the innovative design differential, with standardized specification, ergonomics elements, according to the technical information sheets of the product (FNDE, 2016). By reserving this activity to non-governmental partnerships (National Institute of Metrology, Quality and Technology - INMETRO and Brazilian Association of Technical Standards - ABNT), the NPR contributed to reduce e uncertainty and pressure for R&D investment, for design of innovative processes. In addition, it has collaborated through innovation to the service of human satisfaction, as pointed out by the interviewees.

NFDE server perform a document analysis in order to verify the requirements conformity about products . From this, most of the interviewees registered approval for transparency and impersonality of the process.

The interviewees highlight the impact of risk management as a strong criterion in the manufacturing process. Thus, leading companies agree that success in public competition depends on quality control policies and partnerships to obtain imports of equipment at a fair price, to reduce the margins of error in production.In the context of the furniture sector, the hiring of engineers and the qualification of the employees was an expected result. In the same way, the acquisition of imported equipment was pointed out as the safest investment for business owners. Still, according to the companies interviewed, in most cases, the countries of origin of the machinery were Italy and Germany.

At the same time, NFDE funding to the cities concerned to reduce the aversion to innovation risk inherent in the public sector. This represented, between 2009 and 2015, between 40% and 70% of the contracting of school furniture in the NPR.

Thus, the definition of specification, standardization, investment in machinery, qualification of labor and specific financial transfers for the purchase of school furniture influenced the reduction of risk aversion from the perspective of the furniture industry.

In this sense, it is understood that the business environment for the sector was more attractive, since it induced the investment of the companies by the NPR.

By using portals and systems for the dissemination of public policy, positive effects have been produced for the transparency of processes. Otherwise, public hearings prior to the bidding of each product, as in the case of school furniture, led to the involvement of companies in the furniture sector in the construction of decisions on specifications, methodologies and batch size organization.

In the managerial view, NPR reduces bureaucracy and simplifies hiring procedures through price registration. It is worth noting that the transaction cost of NPR participants does not compromise competitiveness and productivity. Testing in laboratories only occurs after confirmation of victory in the process. As a result, potential suppliers engage in public policy in a pro-trade environment, in less time: from six months (national average) to less than ten days. This is supported by Bonacelli and Foss (2016), Meerveld et. al. (2015), Valovirta (2015) and Vonortas (2015). In addition, this perception converges with the interviewees' point of view.

In addition, it was discovered from the interviews that the technological growth and specialization of the school furniture segment have intensified since the first edition of NPR. With the transmission channels (as analyzed in the previous section), security was generated so that the market wanted to promote adaptation of the industrial park to the government project. In some cases, companies dedicated to the corporate furniture segment migrated to the production of school furniture, expanded factories and altered working hours (2 to 3 shifts).As a result, companies improved their performance through *i)* process innovations; *ii)* acquisition of better machinery; and *iii)* labor force qualification.

5 CONCLUDING REMARKS

In this paper, we analyzed the use of public procurement as an industrial policy tool to improve the performance of the school furniture industry in Brazil, which is a sector dominated by suppliers (PAVITT, 1984). In particular, we analyzed the impacts of the Brazilian Price Register carried out by the Brazilian Ministry of Education on the performance indicators of the Brazilian school furniture industry between 2009 and 2015. We argued that public procurement has been widely recognized as an instrument for innovation and, more broadly, for industrial performance, but most analyses and case studies on this subject focus on the use of PPI in high-technology sectors such as the aerospace industry. We also argued that simple government procurement focusing on standardized products (as described by Edquist and Hommen, 1998) can improve the performance of traditional low-technology and supplier dominated by industries (such as the school furniture industry in Brazil).

We compared average indicators of labor productivity of the furniture industry with average indicators of the firms at NPR group in the period between 2009 and 2015. To cope with causality issues, we used i) documental analysis; and ii) semi-structured interviews with strategic and operational agents of suppliers and potential NPR suppliers. These interviews focused on the link between NPR objectives and results and on a theoretical framework of analysis. Basically, we assumed the existence of a set of transmission channels between public procurement and performance of low technology sectors.

In short, we concluded that NPR suppliers achieved better results than furniture sector. The relevants lessons learned about public procurement innovation were: *i)* reduction of market uncertainties (as a result of a more stable public procurement policy); *ii)* product standardization; and *iii)* gains of scale and, as a result, can improve their performance through *i)* process innovations; *ii)* acquisition of better machinery; and *iii)* labor force qualification. These conclusions were based on the perception of managers and owners of firms of NPR suppliers interviewed during the elaboration of this paper.

Further studies can, however, i) use microdata to compare control and treatment groups; and ii) analyze formats and configurations of lots in order to verify their impacts on performance indicartors.

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Leomir Ferreira de Araujo
Public servant at Brazilian National Fund for Development of Education. MSc in Public Administration.
Leomir.araujo@fnde.gov.br
+55 61 2022.5276

Luiz Ricardo Cavalcante
Legislative advisor at the Brazilian Federal Senate. PhD in Administration. Professor at the Brasilia Institute of Public Law.

The creation of business deals for a sustainable supply chain: The case of rail transportation

Katarina Arbin, Johan Kask and Frans Prenkert
Örebro University, Sweden

Abstract
This paper aims at presenting how business deals are created leading to a more sustainable supply chain through the achievement of improved fill-rates and reduced empty transports. A longitudinal case study has been conducted following a European network of logistic actors over a two-year period of time (2015 – 2017) that has managed to reduce empty transports from the south part of France to Sweden. Literature about business deals in network structures is used to analyze the case. The paper contributes with knowledge about ways to improve load factors, sustainable transport solutions and the creation of business deals in logistic networks.

Keywords: Sustainable supply chain, transportation, deals

Introduction

According to the World Economic Forum 57 percent of all shipments by truck in EU have free cargo capacity on route to destination, and 24 percent of the around 6 million trucks in EU return empty after the goods have been delivered (Doherty and Hoyle, 2009). Also the logistical rail system is currently unbalanced. For example about 50% of all northbound railway cargo wagons travel empty from terminals in Europe to Sweden even though these wagons, in principle, could carry freight northbound (Trafikanalys, 2011).

Unutilized cargo capacity is not only economically costly for the transport providers and the transport buyers: Overall, traffic congestion costs Europe around 1 percent of annual GDP and by 2050 the EU must cut transport emissions of greenhouse gases by 60 percent compared with 1990 levels to limit global warming to an increase of just two degrees Celsius; and despite improvements in energy efficiency, the transport sector still depends on oil for 96 percent of its energy needs (EU Transport Policy).

Faced with these challenges and knowing that a large part of trucks, wagons and cargos are going back empty after delivered goods to final destination, this classical balancing problem requires an improved matching of goods flows and available transport capacities to be solved. Reduced empty transports will contribute directly to a reduction of congestion and fossil fuel dependency and to lower transport emissions affecting global warming in a less negative way. At the same time it may contribute to lowering the shipping costs for logistics service providers and goods owners alike. But how do we do this? How can the fill-rates in a transportation system be improved?

There is a current body of literature focusing on the reduction of empty transports (Basu et al., 2015; Dong and Dong-Ping Song, 2013; Islam et al., 2013; Islam, 2017; McKinnon and Ge, 2006; Xie et al., 2017; Yu and Cristiano, 2014). This literature is however relatively scattered and incoherent, and a large part of the literature is disconnected from other research findings in the area, not building on previous knowledge.

Looking at the literature, focus has mainly been on tools such as auctions for improving the matching (Basu et al., 2015), models of operations in order to find new more efficient strategies for repositioning of empty containers and for empty container inventory sharing (Xie et al.,

2017; Yu and Cristiano, 2014) and mathematical models to tackle the empty container repositioning (Dong and Dong-Ping Song, 2013).
This paper however focus on *how* business deals are created leading up to improved fill-rates and reduced empty transports, contributing to knowledge about business creation in logistic networks. This is in contrast to offering a possible theoretical model as a solution to the problem with empty transports as a large body of previous research has done (Basu et al., 2015; Dong and Dong-Ping Song, 2013; Xie et al., 2017; Yu and Cristiano, 2014). The paper also contributes by using an empirical case of rail wagons instead of cargos and trucks that is mainly the case in previous research (Basu et al., 2015; Dong and Dong-Ping Song, 2013; Islam et al., 2013; Islam, 2017; McKinnon and Ge, 2006; Yu and Cristiano, 2014). Thus facilitating a deeper understanding for reducing empty transports specifically in railway transportation systems.
Even though transportation of goods is an important part of the supply chain, previous literature on supply chain collaboration disregards transportation as an important part of the supply chain (Chan and Zhang, 2011; Feng and Yuan, 2007; Islam, 2017). This is supported by Quarshie et al. (2015) who shows that only five percent of the supply chain articles related to sustainability published in 2007-2013 is about transportation and logistics. Moreover, we share the concern of Islam (2017) arguing that the traditional assumptions and boundaries of supply chain management should be expanded in order to consider the role of transport providers in addressing the challenges that are common in freight transport management. The role of effective and efficient transport is an important part of the supply chain. As an effect of the disregards of transport in the supply chain literature, there is thus limited research focusing on how to overcome challenges that hinder supply chain goals such as reducing empty miles for carriers in order to reduce cost and contribute to increased sustainable transport solutions (Islam, 2017). There is a clear need for more knowledge in this area, both from a theoretical and practical perspective.
The purpose of this paper is to investigate the creation of business deals within a logistic network, its impacts on the organization of the physical flows and the sustainability in terms of improved load factors. Hence this study contributes with knowledge about ways to improve transportation load factors, sustainable transport solutions and the creation of business deals in logistics networks
The structure of the paper is as follows. First an introduction to and description of theory is given followed by a section on methodology. Thereafter the case is presented. The analysis follows and the paper ends with conclusions, contributions and managerial implications. Due to limited space (ten pages) we will not be able to present the analysis as detailed as we wanted, we therefore save the extended analysis to a second version of this paper.

A network approach to business deals
In this paper we proceed from a network approach (Håkansson, 1982; Håkansson & Snehota, 1995; Håkansson & Snehota, 2005). The network approach origins from empirical studies within industrial marketing and purchasing (IMP) and departs from the basic acknowledgement of the fundamental role of interaction processes and relationships for business activities (Håkansson, 1982; Håkansson & Snehota, 1995). In the network theory approach it is the relation between organizations that is key, not the business unit per se, thus emphasizing inter-dependence and interaction.
When comparing the network approach to other perspectives and theories such as the resource based view, the rational planning approach and transaction cost theory, what clearly distinguishes the network approach from these is the view on (company) independence (Håkansson, 1994; Johanson and Mattsson, 1994; Baraldi et al., 2007). Contrary to the network approach where companies have a restricted view of the surrounding network (i.e. firms have limited freedom to act independently, and their actions will be dependent upon the actions of

other firms within the network), a company in the rational planning approach, the resource-based view and in transaction cost theory, is instead able to act independently (Johanson and Mattsson, 1994; Baraldi et al., 2007). The company can carry out its own analysis of the environment in which it operates, develop and implement its own strategy based on its own resources, taking into account its own competences and shortcomings (Baraldi et al., 2007). With other words, the resource based view, the rational planning approach and transaction cost theory are all more firm centric compared to the network approach. In their world it is possible to plan and execute action without being affected by other companies' actions such as suppliers, customers and competitors.

In contrast, the network approach assume less independence. According to Håkansson and Snehota (2006) the propositions of the network approach can be summarized as follows: 1. Business organizations often operate in a context in which their behavior is conditioned by a limited number of counterparts, each of which is unique and engaged in pursuing its own goals. 2. In relation to these entities, an organization engages in continuous interactions that constitute a framework for exchange processes. Relationships make it possible to access and exploit the resources of other parties and to link the parties' activities together. The distinctive knowledge of an organization is thus created through relations with others. 3. Since the other parties involved in the interaction also operate under similar conditions, an organization's performance is conditioned by the totality of the network as a context, i.e. even by interdependencies among third parties. In other words, no business is an island and relationships and interactions are necessary for all meaningful economic activities to happen (Håkansson & Snehota, 1989; 1995; 2006 Håkansson and Olsen, 2015).

Within these network interactions of various kinds, deals and transactions also exists (of course), that are shaped by network relationships and interactions. In Håkansson and Olsen (2015) deals are described as an analytical construct at the intersection between social-material activities on the one hand, and monetary transfers on the other. A deal regulates parts of the exchange situation and defines and shapes parts of the relationship among involved actors, resources and activities (Håkansson & Olsen, 2015; Olsen & Håkansson, 2017). On the one hand there is a complex – and to a large degree informal – value creating interaction process about actual work, services, products and technologies, and one the other hand there are financial resources and monetary cash flows. In between, there are constraining formal deals that are based on these activities that define the exchange conditions between them (Olsen & Håkansson, 2017).

Looking at the making of deals in a network approach context, there are few studies that have addressed and investigated this so far (Håkansson & Olsen, 2015; Olsen & Håkansson, 2017). To us this is surprising since deals and how to make deals happen are vital to companies and their survival, more research is thus needed about deals in a business network approach context. When to analyze deals, Olsen & Håkansson (2017) claim that the analysis should be divided into two different analytical perspectives; the process perspective and the structural perspective. The process perspective involves the emergence of the deal through its history of becoming, and then follow its paths as it interacts and develops in relation to other influencing forces and events over time. The structural perspective involves how the deal relates to other deals on both sides of the dyadic relationship and how the dynamics of deal structures and additional deals both shape the conditions for, and influence the further development of, a given deal.

In this paper we use the definition by Håkansson & Olsen (2015) and the way of identifying and analyzing different components affecting a deal by Olsen and Håkansson (2017). We thus use the analytical framework suggested by Olsen and Håkansson (2017) when analyzing our empirical data in order to identify and analyze the different components leading up to, in our case, a deal leading to improved fill-rates and reduced empty transports.

Analyzing business deals in networks

When analyzing the deal, we use the framework from Olsen and Håkansson (2017) consisting of six points that warrants attention. While using this framework as a point of departure, this paper however enrich the analytical framework by of adding in more detail concerning what to analyze within the different points. In this way we add empirical detail and content to the points helping structure the analysis further. The framework by Olsen and Håkansson (2017) is as follows:

1. Who is involved in the deal?
   Through this question we want to analyze first, which actors such as suppliers, customers, collaborators, facilitators etc. are involved in the deal, secondly, what are their roles in the network and the deal, third, how are they connected to each other and fourthly, what kind of relationship do they have with each other? This relates to actors both as organizations and as individuals and we want to capture a variety of types of interactions. For example, if there are there personal relationships between individuals or have they communicated only through e-mail and over the phone, do they know each other from before, have they done business together previously etc.
2. Who is taking the initiative?
   Though this question we want to analyse who (actor and person) that took the initiative to show the origin of the deal.
3. What is the deal about? What are the specific challenges faced by the project? Through this question we want to analyse what the deal is about and challenges faced by the project/business set-up. Here we also include and analyse how challenges were possibly overcome.
4. What characterizes the money-handling process?
   Through this question we analyse characteristics of the money-handling process in the rail transport industry context, showing the money streams going between different actors. We also analyse the level of transparency, i.e., how transparent are the involved actors, and how is overall profit distributed between the players/actors.
5. Are there clear relationships to other deals?
   Through this question we analyse first, if there are relationships to other deals, and secondly, if so, to what other deals and in what way have these relationships influenced the focal deal in this paper.
6. Are there particular consequences for the involved actors with respect to future participation in the project?
   Here we modify the question somewhat and phrase it "Are there particular consequences for the involved actors with respect to future deals?" This instead of "…with respect to future participation in the project". This since we are interested in consequences for actors in future deals through being part of this deal, and how this has influenced the deal making in this case.

A Longitudinal Case of a European Logistics Network

A longitudinal case study was conducted following a European network of logistic actors over a two-year period of time (2015 – 2017) that has managed to reduce empty transports from the southern parts of France to Sweden. The logistic network has during a relatively short period of time managed to fill wagons in a return flow that used to travel empty from France back to the original destination in Sweden every month. Semi-structured interviews with key persons in the logistic network has been conducted together with observations at meetings and documentation studies. Also group interviews have been conducted. Altogether around 25 interviews were conducted with persons in 6 different companies with different roles, such as goods owners, terminal operators, logistics organizer, etc. On average the interviews lasted for two hours. The interviews were recorded and parts relating to the case were transcribed. After a first case description had been produced it was sent back to the persons interviewed for

respondent verification. Following this the case were complemented in order to ensure factual accuracy and relevance. While some actors may have slightly varying views on what is going on, in this way facts and figures were quality assured. Following revisions the case was again sent to the interviewees who approved it.
As a complement to interviews a number of site visits were conducted in which for example, a terminal operations and layout were experienced firsthand by the researchers, and where the flow of some specific good could be followed.
Finally, whenever secondary data in terms of company records, web-site data and information from industry journals and agencies could be found, this was incorporated in the case to provide depth and nuance.
In this way multiple qualitative data sources were used to build a case (Yin, 2009). The use of case methodology to investigate business network is a fairly established tradition (Halinen and Törnroos, 2005). It benefits the dynamic and contextual characteristic of business network phenomena and is thus a well suited to capture processes and structures (in terms of contextual conditions) such as the ones in our framework of business deals in networks. Our ambition is to use the case to provide interesting empirical descriptions paired with new theoretical insights as a way to develop theory (Vaughan, 1992; Eisenhardt, 1989).

Case Description: The Creation of a New Deal
The case describes the journey going from a low fill rate in a northbound return flow in a rail transportation system to a large increase in a relatively short period of time and how this happened. The case describes the process leading up to the deal, including actors involved, how they are organized, how dependent they are on each other in making this deal happen and main conditions and i.e. factors leading up to the positive result.
The main actors involved in the case are a European freight forwarder, a fourth-party logistics (4PL) provider based in Sweden, a Swedish paper and pulp producer, a freight rail terminal in the southern France, a freight train terminal in Sweden, a European provider of wagons and a company in Spain selling laundry detergents.
The case starts with a 4PL provider that has empty capacity in the wagons going from the southern of France up to Sweden that needs a deal with someone in order to fill the wagons. The context is railroad.

How the deal happened
Some years ago the account manager of the European freight forwarder had direct contact with a Swedish paper and pulp producer being the subcontractor responsible for terminal services in the southern France. Through the paper and pulp producer the freight forwarder also came in contact with the Swedish 4 PL provider. Through this contact the freight forwarder gained knowledge about the empty capacity in wagons going from the terminal in the southern of France up to Sweden and that transportation space could be bought to a relatively low cost.
As background information it should be mentioned that in Spain the train width is different compared to the train width in France which means that goods coming by train from Spain through France need to be reloaded in order to continue travelling north. The freight forwarder had made a business form this, offering their services to customers from the Spanish side wanting to ship goods north though France. The freight forwarder thus had previous experience of Spanish customers wanting to ship goods northbound through France. They also knew the region well, having knowledge about potential customers and how they currently shipped their goods.

"*There appeared an opportunity, corresponding well to existing conditions*."
Account Manager at the freight forwarder

The account manager of the freight forwarder knew since before about a plant in Spain close to the French border belonging to a large international company that produced laundry detergent. He had taken note of their tenders through the years, but they were always long and challenging to respond to. Autumn 2016 he got information that the plant had been sold to a Spanish company and that they were about to deliver laundry detergent to a customer in Sweden.

"*I got a tip from a carrier that something was going on towards Sweden and then a person close to my family that worked for the large international company told me that they had sold a plant close to Barcelona. At the same time I remembered an inquiry to Sweden that I thought was a bit strange. All those things together made me realize that there could be a new northbound flow*." Account Manager at the freight forwarder

The freight forwarder approached the plant directly and got in contact with the right persons presenting an offer, which resulted in a deal. In order to get the deal, several practical conditions involving other actors had to be in place.

a) That there was a northbound flow already in place from the southern France to Sweden. This was offered by the 4PL provider.
b) That there was enough space at the freight rail terminal in the southern France for loading activities. This was achieved through the rail terminal in southern France.
c) That there were enough and the right type of wagons (for transporting consumer goods as laundry detergent), and also a possibility to add wagons if needed. This was offered through a collaboration with the European provider of wagons.
d) That the rail terminal in Sweden had previous experience of handling consumer goods.

The deal resulted in an increase in fill rate, going from 48 to 91 percent in six months' time.

The freight forwarder is the actor selling the solution, a door-to-door concept to the end customer, by using subcontractors to enable the offer. The freight forwarder is thus overarching responsible for the freight from the plant in Spain to the terminal in Sweden, and responsible for coordinating subcontractors and surveillance. The end customer, the Spanish plant, pays the freight forwarder that in turn pays its suppliers/subcontractors.

The freight forwarder played a central role for the deal to happen. It was the freight forwarder that initiated, coordinated and made the deal happen. The local anchorage was important, as was knowledge about the region and contacts. The subcontractors played an important role in enabling the door-to-door offer. Without the rail terminals, the 4PL provider and the European wagon supplier, the solution had not been possible. And without the Swedish paper and pulp company the freight forwarder would not have known about the 4PL provider and its empty carriers going northbound from southern France.

Preliminary analysis

Due to space restriction this analysis is a tentative analysis analyzing the case only on an overarching level not going into detail under each point in the analytical framework. The first point by Olsen and Håkansson (2017) is illustrated in figure 1 and the rest is summarized and presented in table 1.

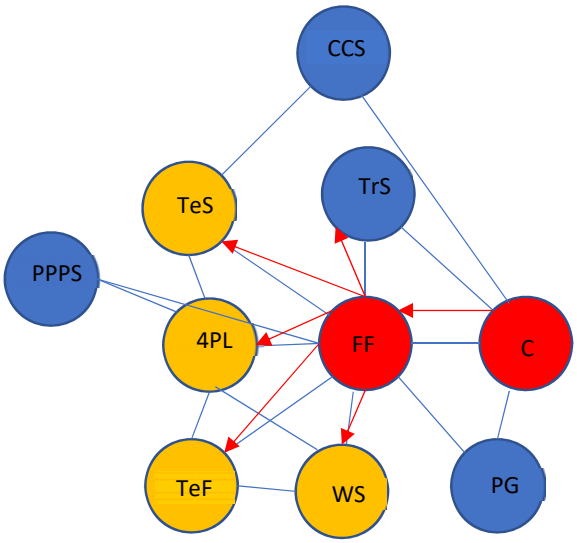

Figure 1. Who is involved in the logistic deal?
Red indicates directly involved, yellow indicates enabler and blue indirectly contributing to the deal.

Abbre-viation	Meaning
CCS	Customer to Spanish customer, located in Sweden. Customer Customer Sweden.
C	Customer, laundry detergent plant in Spain.
PG	Procter & Gamble employee informing freight forwarder person about potential deal.
TrS	Truck supplier, driving goods from outside Barcelona to Southern France.
FF	Freight Forwarder
WS	Wagon Supplier
TeS	Terminal Sweden
TeF	Terminal France
PPS	Paper and Pulp Producer in Sweden
4PL	Fourth-Party Logistics provider HQ in Sweden.

Point	
2. Who is taking the initiative?	Initiative to the deal is taken by the European freight forwarder, but the Swedish 4PL provider also have part in communicating free capacity to a relatively low cost due to return flow and pushing for a deal.
3. What is the deal about? What are the specific challenges faced?	The deal is about finding a win-win-win solution. From the 4PL provider perspective; filling the empty wagons going from southern France to Sweden. From the customer perspective; transporting goods in a secure and cost effective way from the border of Spain to Sweden. From the freight forwarder perspective; make a deal to make money. Challenges faced and overcome were: a) finding the right type of wagons for transporting laundry detergent and a flexibility in adding wagons if necessary, being able to promise that volume could be managed, b) availability to enough space at the terminal for unloading, loading and short term storage, c) offering a terminal in Sweden close to the customer's customer that had previous experience of managing consumer goods.
4. What characterizes the money handling process?	Money-handling process: the customer, the Spanish laundry detergent plant pays the freight forwarder that in turn pays its suppliers/subcontractors including the Swedish 4PL provider, the European wagon provider, the two terminals and its truck supplier (transport by truck from plant outside Barcelona to the terminal in southern France). For payment flows also see the red arrows in figure 1 above.
5. Are there clear relationships to other deals?	Regarding clear relationships to other deals, the main actors involved in facilitating the offer and i.e. the deal through the freight forwarder all knew each other from before, they were also involved in a parallel tender during this time resulting in a deal transporting goods from the Netherlands to Sweden. The freight forwarder knew about the customer (plant outside Barcelona) but no previous deal. Among the suppliers there were previous relationships to other deals, but not between the supplier network and the customer. None of the other actors except the freight forwarder in the supplier network knew about the customer's existence from before.
6. Are there particular consequences for the involved actors with respect to future deals?	Through participating in this deal, suppliers in the network (4PL provider, provider of wagons, terminals and the freight forwarder) get to know each other better, contributing to a stronger relationships. This will probably lead to more discussions how to collaborate and offer transport solutions through the freight forwarder. For the 4PL provider having a strong relationship with the freight forwarder and other European rail actors this enables business opportunities that the 4PL provider would otherwise not be aware of existed.

Table 1. Tentative analysis point two to six.

Conclusions, contribution and managerial implications

Conclusions

A conclusion is that none of the actors involved in enabling the deal could have offered the logistic solution by themselves. They are all dependent on each other in order to offer the logistic solution. None of the companies can be viewed as being independent, for all of them relationships to and interactions with other actors are necessary for the logistic offer to be possible. As the network approach argue, it is relationships that make it possible to access and exploit the resources of other parties and to link the parties' activities together. Without relationships and previous interactions with the 4PL provider, the supplier of wagons and the

terminals, the freight forwarder could not have offered the solution and i.e. realized the deal with the laundry detergent producer. Working together as a network is a prerequisite in order to make this kind of deal leading to reduction of empty transports through Europe and at the same time making money. The freight forwarder can however be viewed as the most important actor for the deal to happen, having knowledge about and contact in the region and i.e. contact with the customer. The freight forwarder acted professional and had the ability to get an offer together consisting of several actors and their services. Other actors were however needed in order to offer the solution.

Contributions

This paper has contributed to literature on deals in a network approach context through further enrich the analytical framework by Olsen and Håkansson (2017), this by adding in more detail concerning what to analyze within the different points. The paper has also contributed through using the analytical framework in another empirical setting, showing its relevance also in the rail transportation context. The paper also contributes with knowledge about the creation of deals in order to reduce empty transports in a railroad context, the importance of relationships and interactions resulting in creating and offering logistic solutions together with other actors.

Managerial implications

For a manager working in this empirical context it is a good idea to have an understanding of the importance of relations and interactions with other actors in the industry for finding new customers and improving fill rates. It is also good to be transparent about surplus resources and to some extent also regarding costs related to certain activities within the network of logistic actors. As a manager you need to have an understanding of where in the system there are surplus resources and make use of it. As a manager you also need to go outside your own organization and together with others find what is beneficial for both. In this case it was cooperation and "show the cards", being transparent with surplus resources and to a certain extent with costs, which gave the deal.

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Engaged Scholar(ship): Creative tension or squeezed in the middle?

Jenny Bäckstrand
Department of Industrial Engineering and Management, Jönköping University, Sweden.
Email: Jenny.Backstrand@ju.se, Tel +46 36-10 16 29

Árni Halldórsson
Division of Service Management and Logistics, Department of Technology Management and Economics, Chalmers University of Technology, Sweden
Email: Arni.Halldorsson@chalmers.se, Tel: +46-31-772 15 82

Summary
Purchasing and supply management influences practice through advancement of knowledge and theoretical principles and positions itself as an academic discipline. For the individual researcher, this calls for skills and experiences that can be associated with engaged scholarship. This paper explores tensions inherent in engaged scholarship, namely the quest to interact closely with professionals to ensure relevance and impact whilst at the same time live up to research quality criteria. The paper concludes that the individual researcher in a field such as PSM is easily left with guidelines that point in multiple directions as regards personal achievement and institutional merits.

Keywords: Engaged Scholarship, PSM, Professional Development of Researchers, Tensions.

Submission category: Working paper

Background
Scholarship in purchasing and supply management (PSM) intends to advance both theory and practice. As an applied academic discipline and a profession, the field has achieved a distinct status in industry by shaping and influencing how purchasing professionals operate through inter-organisational relationships in a wider context of supply networks. The field is developing as an academic discipline (Harland, Lamming, Walker, Phillips, Caldwell, Johnsen, Knight and Zheng, 2006; Johnsen, 2018; van Weele and van Raaij, 2014) and is still maturing (Wynstra, 2016) and getting a greater scholarship recognition (Zsidisin and Ancarani, 2016).

Another important feature in the development of PSM is the interaction between PSM scholars and professionals. Since PSM has increased in relevance for companies (Wynstra, 2016) and developed from a functional to strategic function (Johnsen, 2018; van Weele and van Raaij, 2014) it comes naturally that PSM scholars have become increasingly involved in interdisciplinary projects focused on research's relevance to practice (Knight, Tate, Matopoulos, Meehan and Salmi, 2016). That is, to become more engaged scholars that can balance rigor and relevance (van Weele and van Raaij, 2014) and use novel methods that are likely to improve understanding of known concept, or study new phenomena (Knight *et al.*, 2016). Van de Ven and Johnson (2006, p. 803) define engaged scholarship as "a collaborative form of inquiry in which academics and practitioners leverage their different perspectives and competencies to coproduce knowledge about a complex problem or phenomenon that exists under conditions of uncertainty found in the world." However, being the academic part of this collaborative form of inquiry comes with a price; not only do the researcher have to conduct rigorous research to coproduce knowledge about complex problems found in the world but should also be able to communicate and contribute to both academia and practice.

This paper builds upon the notion that the individual researcher experiences pressure from several directions, that deliver mixed messages about what tasks should be prioritized, what is being appreciated as output with relevant merits, and who the beneficiary of the outcome is. Also funders put requirements on business impact, utilisation and "technology readiness levels" as part of the research rather than part of the post-research dissemination (Wise, Berg, Landgren, Serger, Benner and Vico, 2016). The response to this development has been that an increased use of inductive and abductive reasoning as well as more participatory research methods that supports research relevance has become more acknowledged by e.g. academic journals (Knight *et al.*, 2016). On the other hand, whereas engaged scholarship may provide rich or novel insight for both academia and practice, it requires time, experiences and skills that are not always at hand for the individual researcher or may be in contrast with e.g. high pressure on a single dimension of research output, namely publications in highly ranked journals to attain promotion and tenure.

On the background of this, the purpose of this work-in-progress paper is to explore the tensions entailed in engaged scholarship as seen from the perspective of the individual researcher. The contribution of this paper is that we identify and describe various factors influencing the individual researcher. Then we identify and describe the tensions that arises when these influencers are contrary or conflicting and explain how they are inter-related.

Method/approach

This paper focuses on the relationship between engaged scholarship and PSM. Based upon the notion that PSM is an applied field that needs to develop further it's academic position, the tension that engaged scholarship entails will be conceptualised and explored. The study is at first hand based upon review of articles within PSM that are regarded of relevance to this, in particular on research methodology and theorizing in the field. Here, we also draw upon literatures on scholarship and collaborative research methodology. This is complemented by reviews of secondary evidence and archival data such as web-pages, reports and local instructions assessments of merits for promotion and when assessing research quality of academic institutions.

The approach taken is threefold: (1) *Literature* on theorizing and on research methods within participatory and collaborative research design is examined to conceptualise the "and" in rigor and relevance, and to provide background for concepts such as engaged scholarship in the analytical framework. (2) The *use of research methods* within PSM has been reviewed and analysed with respect to dimensions of engaged scholarship and scholarship in general (including application and integration). (3) *Tensions* that may arise between different influencing factors since the individual scholars do not only have to adhere to methodological principles but also operate in the context of institutional arrangements such as academic merits and reward systems have been identified. Accordingly, a *behavioural approach* (Bendoly, Donohue and Schultz, 2006) is taken to explore how the researcher as an individual relates to priorities set out by engaged scholarship and their institutional environment. By this, we suggest that the way by which engaged scholarship is operationalised is not only through the attributes of research method but also the conditions under which the individual researcher work, such as incentive systems, journal rankings and promotion criteria.

In order to strive for both rigor and relevance of our research we build upon the design science method (Hevner, March, Park and Ram, 2004) in order to understand, execute, and evaluate research focusing on the needs of an individual researcher in an academic setting within the PSM domain. The methodology applied is an exploratory multi-method approach initiated with a literature and document review resulting in a set of tensions. The next step in the design cycle will be to assess the framework using empirical data collected from PSM scholars at the 2018

IPSERA conference and analysed by using the principles of concept mapping (McLinden, 2017; Vaughn and McLinden, 2016).

Conceptual background

A call for more engaged scholarship – an external perspective

Given the nature of PSM as a field, we take a rather broad view on scholarship by following Boyer's (1990) distinction of scholarship that involves discovery, integration, application, and teaching, with our particular focus on the more engaged parts; integration and application. The interest in research approaches that can be associated with engaged scholarship seems to be increasing, both in the literature on qualitative methods and general management in general, but also in PSM in particular. Scholars in applied fields such as PSM have found it challenging to defend the scientific status of their research, both in terms of quality of publications, and in large when the field is compared with other academic disciplines, since the applied quality assessment criterions are not appropriate for engaged research.

First, much debate has taken place on how to balance academic rigour with practical relevance. There seems to be a general view that scholars must address both in their research (van Weele and van Raaij, 2014). This is not just a matter of writing about it in a journal article; rather, this relates very much to the research design and the conduct of research i.e. whether, or to what extent, rigor AND relevance being addressed. We find it useful to relate the dichotomy of rigor and relevance to scholarship in a wider perspective. Accordingly, our work is based upon Boyer's (1990) typology of scholarship that emphasises *integration* and *application* of knowledge.

Advancement through *integration* of perspectives across disciplines has had important impact on the development of PSM and its ability to deliver relevant results. This has resulted in the use of broader range of research methods (see e.g. Knight *et al.*, 2016) as well as borrowing "grand theories" from other fields such as management and economics (Carter, Kosmol and Kaufmann, 2017; Halldórsson, Hsuan and Kotzab, 2015). Relevance in this context does, though, not necessarily refer to practice or professionals, but rather relevance of PSM for other disciplines (see e.g. van Weele and van Raaij, 2014). One part of this development is the interaction of PSM with related areas such as supply chain management (Larson and Halldorsson, 2002) and industrial marketing (Johnsen, 2018), and by adopting theories from other disciplines such as transaction cost economics (TCE) and the resource-based view (RBV) (van Weele and van Raaij, 2014; Wynstra, 2016). Recent evidence also shows that this cross-fertilization is bidirectional; PSM does to an increasing extent contribute to journals in general management and economics (Wynstra, 2016).

Application of knowledge reflects in the way by which scholars interact with industry and professionals in research. The knowledge-creating relationship between the scholar and the professional is viewed from a *bidirectional perspective*; the knowledge is created at the intersection between scholars and professionals, i.e. research with rather than on practitioners. That is in line with the definition of "engaged scholarship" by e.g. Van de Ven and Johnson (2006), which has also been acknowledged in PSM (Walker, Harland, Knight, Uden and Forrest, 2008).

Second, another call for engaged scholarship comes from the emphasis on *theorizing*. Advancement in knowledge is not only stated in terms of "theory" or "testing theory" but also "theorising" (Swedberg, 2012); what the researcher does to produce a theory. This view brings particular attention to the *people dimension* of the researcher (or the scholar); the role of the researcher as individual in the act of theorizing in that it is "deeply personal in the sense that you can only theorize well by doing it yourself and drawing on your own experiences and

resources" (Swedberg, 2012, p. 2). A focus on theorizing pushes the boundaries of the current state of PSM research, which "has progressively evolved from a dominant exploratory focus to theory building and theory testing" (Wynstra, 2016, p. 218).

Third, new opportunities and challenges such as digitalisation may have disruptive consequences for the way in which managers operate, have led to greater *complexity*, which in turn requires more use of qualitative research methods to advance and disseminate knowledge (Guercini, 2014). Bringing PSM research closer to the particular context through balanced approach to rigor and relevance is not so much about dichotomy that is impossible to join, but rather about broadening a perspective of scholarship that bridges theory and practice through *theorizing*, acknowledgement of the researcher as individual, and the ability to solve *complex problems* through the use of qualitative research.

A call for more engaged scholarship – a PSM perspective

Scholars in PSM have reacted to the call for a broader perspective on research and scholarship. Considering the account of PSM by van Weele and van Raaij (2014), Wynstra (2016) and Johnsen (2018), the field has put more emphasis on scholarship of integration than on scholarship of application, by borrowing theories and concepts from other disciplines. PSM has acknowledged the importance of engaged research approaches (e.g. Walker *et al.*, 2008) and interaction with industry and professionals (Knight *et al.*, 2016). The research designs that dominate PSM are still surveys and conceptual approaches (Wynstra, 2016). Next to these in frequency of use are case studies, but the use of participatory and collaborative research approaches is "marginal in comparison" to these three predominant methods used (Wynstra, 2016). However, this does not say anything about the entire population of conducted research, only the sample that has been published. Earlier stream of research in PSM has assigned case studies, and in particular "casing", an important role in both advancing the development of the discipline in terms of theory development and by bringing operational closure between theory and data (Dubois and Araujo, 2007). And this quest for closure is still high on the agenda in PSM, where the points of reference cut across the research process, ranging from problematizing the particular study through use of methods and towards journal publications. First, Dubois and Salmi (2016) follow Alvesson and Sandberg (2011) by calling for *problematization* rather than gap-spotting to motivate research problems. To support this, they call for a more "diverse approach" to case studies than hitherto used in PSM. Second, Zsidisin and Ancarani (2016) observe that the core idea of JPSM is to *publish* research to advance *both* practice and theory. They also identify co-authorship between researchers and practitioners as further indicator of combination of rigor and relevance. Third, Knight *et al.* (2016) call for more *use of novel methods* in PSM research to promote learning and innovation. They continue to state two drivers of change; *concern* in terms of engaged PSM researchers and *curiosity* in terms of carrying out interesting research. Meehan, Touboulic and Walker (2016) claim that PSM needs an "engaged research" and pave the way for use of action research to influence organisations to engage in responsible PSM practice by challenging the "more dominant versions of PSM impacts". Common to these views is the quest for more proximity to, and engagement with, the profession of PSM in research, ranging from design, data collection and to interpretation of data and dissemination. This requires, however, the individual researcher to spend *more* time in the field, in an era where research quality of their institutions and individual merits during e.g. promotions are primarily assessed through non-engaged measures such as 'publications in highly-ranked journals'.

The call for advancement of research methods entails both strengthening current approaches and diversifying by seeking new ones. PSM seeks to *diversify* towards an increased use of more engaged research methods e.g. more diverse approach of case studies (e.g. Dubois and Salmi,

2016), use of novel methods (Knight *et al.* 2016) and action research (Meehan *et al.* 2016), but there are other pathways as well. van Weele and van Raaij (2014) put emphasis on *enhancement* of current methods and suggest that more replication studies and meta-analysis will both enhance rigor and benefit the field. Ellram and Tate (2016), on the other hand, suggest that secondary evidence may be useful to strengthen the use of multiple source of evidence. It is, however, particularly the diversification that paves the way for engaged scholarship.

The scholar as a part of research practice – influencers

This section suggests that the work of scholars in PSM is affected by influencers. Understanding the implications of these leads to a number of tensions that are derived from these. We refer here to 'influencers' as factors that shape the priority and work of the individual scholar, and act as point of reference for achievements across various dimensions. Based upon a review of literature and scrutiny of secondary evidence, two main categories of influencers are suggested. First, *institutional* influencers refer to the external environment of scholars and their academic disciplines that range from funding bodies and national schemes for assessment of research quality towards guidelines for assessment of achievement of individuals during recruitment and promotions. Together, these can be associated with accountability of research output in various forms and levels. The second category refers to *PSM as an academic discipline* and can be viewed as a more bottom-up, compared with the top-down nature of institutional influencers. Under here, academic journals, the nature of the subject area in terms of methods as well as concepts and collegiality are considered.

Methods are here given particular emphasis here as they define the space between research and practice, and it is often with reference to methods that the discussion on rigor and relevance takes place; we talk about advancement and development of our fields in terms of methods (e.g. JPSM special issue in 2016); and it is in this domain that the researcher as individual – with skills, tools and personal characters – can become engaged (and theorize, cf. Swedberg's 2012 account of this as being quite personal effort).

Institutional influencers

1. Funding criteria, which are diverse in scope. On one end, we have the large government funding agencies (e.g. VR and SSF in Sweden) in which subjects such as PSM may find it difficult to compete with more established disciplines from natural science and basic research. Here, strong focus is on the scientific status of the applicant, publications, and international experience. Other funding bodies focus more directly on innovation and industry competitiveness and are concerned with relevance and application of results through e.g. "Technology readiness level" and "Industrial leadership" (e.g. Horizon 2020, and KKS and Vinnova in Sweden). Here, scholars are expected to involve companies as project members to co-fund projects and co-create knowledge, to ensure that there is a commitment to both availability of empirical evidence and opportunity for intervention. A strong industry-consortium adds to the legitimacy of research applications, and being an engaged scholar is more or less a requirement.

2. National research assessment schemes that are common in e.g. UK and the Netherlands, and are emerging elsewhere on the agendas, e.g. in Scandinavia. Focus is on research output, and whether it is the intention or not, quality and number of journal publications as well as citations and international collaboration that can be conveniently depicted through bibliometrics have become increasingly important part of these assessments. Also included here is research environment (e.g. doctoral students, research funding) and research impact on practice, albeit practice for assessing this type of achievement is much less developed compared with the interest institutions and governments have in bibliometric data. As an engaged scholar this might mean that a considerable part of your work is not subject to assessment.

3. University promotion criteria and reward systems cut across all scholarly activity, and regard both internal and external working environment of scholars. Although these are very broad in scope, and some variance occurs amongst institutions, both nationally and internationally, one criteria tends to dominate decisions for promotions and rewards, namely achievement in research in terms of number of papers, number of citations, level of journals, and co-authorship internationally. Scholars are also expected to demonstrate excellence in teaching and ability to develop new techniques, courses, programs (at all levels), have experience in working with industry in different modes, and attract external funding. Furthermore, successful scholars should also contribute to services to the academic community as demonstrated by active involvement in academic associations, research councils, funding bodies and evaluation committees, both national and internationally; editorship or member of editorial review boards of scientific journals, review activities, experience as opponent at doctoral defenses/vivas (e.g. Ministry of Education and Research, 2014).

Influencers: PSM as an academic discipline

4a. PSM – methods: Sensitivity to the empirical context can be seen as part of theorization in PSM (see e.g. Halldorsson *et al.* 2015). Such proximity can be created through particular type of *research methods* but is also determined by the nature of the concepts and theories under scrutiny. The type of knowledge and the way by which scholars interact with industry/ professionals in their research can be understood in relation to the predominant *methods* in the field, in PSM being surveys, conceptual work and case studies (Wynstra, 2016). As influencer, method can point scholars into directions: using common research methods and build upon established practice and enable more replication studies. Or, to use current status of method usage to seek new boundaries through new or emerging methods and collaborative approaches that enable greater proximity to the empirical field, which have been called for, but are not yet common in published material.

4b. PSM – domain: *Concepts and theories* of the subject area may also set conditions for the work of scholars; when operationalised, a particular method may be called for that considers the particularities of these when investigated. A recent account of PSM in industrial marketing and management by Johnsen (2018) identifies four themes, all of which leave an impression of PSM as an intersectionist-concept (e.g. Larson and Halldorsson, 2002); PSM relates to marketing, new product development, and services. Further, networks as theme in PSM indicate that the perspective of a set of actors is also to adhered to. LaPlaca, Lindgreen and Vanhamme (2018) point out that when units such as dyads are studied, it is natural to collected evidence from both parties of that unit, i.e. the method must match the concept. Johnsen (2018) suggests that future research must pay more attention to both theory and management of networks, hence calling for even more sensitivity to the context and attributes of engaged scholarship such as the concept of arbitrage for "surpassing the dual hurdles of relevance and rigor in the conduct of fundamental research on complex problems in the world" (Van de Ven and Johnson, 2006).

5. Journal editorial policies and practice: Editorial *policies* outline a brief scope of a journal, and do frequently refer to improvement of industrial practice, practical relevance, managers, practitioners and professionals in their target group statements. Such statements were found in the statements of eight of nine journals relevant to PSM scholars that were reviewed for this research (JPSM; JSCM; IJOPM; IJPDLM; IJPE; JOM; OEMGA; POM; SCM:IJ). However, non-practitioner-oriented research still constitutes the majority of papers published in the area (Bäckstrand and Säfsten, 2017), regardless of what their stated audience or mission is. As regards editorial *practice*, LaPlaca *et al.* (2018) mention potential for citation as a factor that may increase chances of an accept of a manuscript. Further, based upon our personal experience, considering H-index of a researcher and likelihood for citation may also be factors

that cross minds of an editor, whether that is to attract a paper to a e.g. special issue or to judge the validity of the findings of a manuscript.

6. Academic citizenship and work-life balance: As an academic, other tasks than the ones stated under 'University promotion criteria' might be required from you. In a report from 2017 Gosling gives 12 examples of such engagement activities; Contributing to media coverage, Industry engagement, Leading research centres, Leading executive education programmes, Knowledge transfer partnerships, Working with associations, institutions and bodies, Writing guides, articles and books to support practitioners, Popular science speeches and articles, Linking research, teaching and practice, Winning awards, Hosting events, and Informing policy, public sector and government. As a 13th activity we can thus add "write department reports". These types of engagement are more often than not, carried out outside regular working hours, hence affecting the work-life balance (Burg and Macfarlane, 2017).

In summary, this list of influencers is quite diverse, and leaves an impression of ambidexterity or even multidexterity as regards scholars in PSM. These can both relate to a multitude of opportunities and the sense of being squeezed in the middle of conflicting and contrary influences. The following section addresses this further in terms of tensions.

Analysis – tensions

A tension refers to ambiguity and even conflicting messages from influencers to the scholar as an individual. This logic is summarised in Figure 1. One form is *divergence* in the consequences of the influencers, they simply contain conflicting directions. Another firm is *variety*; influencers provide multiple directions. Finally, *volume*; the scholar is expected to do more of the same, without a reflection upon what do reduce or remove.

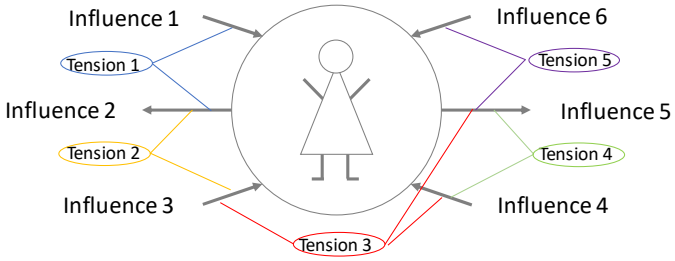

Figure 1. The Engaged scholar - Creative tension or squeezed in the middle?

The tensions reviewed below are derived from analysis of the influencers above, both in relation to each other, and ES. In this paper, priority is given to divergence of influencers.

T1 – Actionable and publishable? Usefulness of research is associated with actionable knowledge, which refers to a particular form that allows for an effective intervention and prescribes how to solve a problematic situation in practice (e.g. Van de Ven and Johnson, 2006). Although editorial policies of journals relevant to PSM explicitly identify practice or managers as audience, our review of managerial or practical implications in JPSM from 2015-2018 suggests that these primarily describe what can be done, but do seldom spell out the particular situation, or move beyond description towards prediction or solution. They stay at the 'may be' rather than 'will be' form. This may be due to the journal article format, conventions, or simply because we as scholars write implications for practice with other scholars, not managers, as intended readers. Interestingly, only one out of nine journals reviewed, namely JSCM, states clearly that practical oriented papers should be submitted to practitioner-journals.

T2 – Funders and use or research methods in PSM: This is a tension between what funders of applied research would expect (relevance, industrial competitiveness, innovation), and the

predominant methods use in PSM (survey, conceptual approaches, and case studies). One way of advancing the field is to make more use of same methods through e.g. *replication studies or meta-analysis*. Whilst this may support rigor (e.g. van Weele and van Raaij, 2014), the quest by funders to create business impact for increased competitiveness and results at an advanced technology readiness level, i.e. almost market ready solutions. Two questions emerge out of this. First, will funders provide resources to replication studies that may be more relevant for the rigor of PSM than the relevance to practitioners? Second, it is argued above that more relevant research needs more collaborative research approaches. The (rhetoric) question is what is whether current method portfolio in PSM will allow us to move beyond incremental changes, or whether we need more disruptive challenges that make collaborative and action-oriented methods more prevalent?

T3 – Do funders line up with calls on PSM subjects? As profession, PSM has grown in size and relevance, and gained a strategic position in many organisations. Interestingly, though, open calls for funding applications do seldom refer to PSM as the main focus. Rather, the subject can be a part of a call that e.g. refers to 'value chain' and 'suppliers', but calls tend otherwise to be sectoral, e.g. on transportation and healthcare. This may explain the intersectionist focus of PSM, i.e. to get funding, we seek theorization of PSM through topics announced by funders. This means that the development of the field as e.g. reviewed by Johnsen (2018) is not only a subject of the 'freedom' of the individual scholar but also influenced research funding bodies.

T4 – Collegial nature of PSM and ES vs. the "new public management" regime: Many characteristics of PSM such as focus on study of different actors in a supply network, and link with other functions such as marketing, services and new product development are collaborative in nature. Same regards the researcher-practitioner feature of ES. First, these stand in contrast with the new public management that is infused into academia through national research assessment schemes, and that in their operationalisation put emphasis on codified achievements such as bibliometrics rather than dealing with more intangible outcome such as business impact of research. Second, creating networks with industry, and studying supply networks can be time consuming, and may happen at the cost of spending more time on publishing papers in journals, which in turn reflects in achievement in terms of bibliometrics. Yet, academic citizenship and its association with collegiality is of immense importance for both young and senior scholars.

T5 – Happy idiots? The multiple nature of influencers requires good management and leadership skills to coach scholars through their career development in prioritising relevant activities at particular stages of their career. Funders pull towards practical relevance of research whereas rigor and journal publication have high status in reward systems and national assessment schemes. Adding good citizenship in academia to this, it and becomes an easy task to get lost in relevant tasks such as developing educational programs, spending time on attracting funding and managing large research projects, and working with industry, all of which are given lower priority than highly ranked journal articles when it comes to academic promotion or recruitment.

T6 – 24 minus 8 -- who gets the other 16 hours? Since the individual researcher is expected to contribute to the academic society, and even society at large, regardless if this in included in their job-description or not, this usually results in a work that takes place outside usual working hours. Academic "work" is easy to mix up with "life", and at an early stage of their career, many scholars experience difficulty in managing the work-life balance; requirements are immense, leadership is often note geared to deal with these and to create conditions that allows talents to grow and get promotion, and some big steps in the career development take place at a time when scholars are establishing families or re-locating for new universities. This affects

parents in general and female academics in specific since the society traditionally have higher expectations on mothers taking the main responsibility for the family and the household chores.

Final remarks

The scientific status of our subject area, ranging from SCM in general, towards logistics, PSM and operations, as well as practical relevance of research of these, is of growing concern for various stakeholders. A predominant point of reference has been the need for both rigor and relevance in research, which often takes place through discussions on what topics and research methods to pursue and moving towards more 'theorizing'. One way of responding to these increased or new expectations is through engaged scholarship. Even this pathway is strongly concerned with methodological matters, where knowledge (transfer, creation, and co-creation) and interaction between researchers and practitioners are in focus. However, less attention is paid to the individual researcher; what does all this mean, and what does it mean to be (or become) an 'engaged scholar'? The relevance of such focus on the individual is only enhanced by the understanding of theorizing as an important part of advancing the field; theorizing builds very much upon the personal experience and resources of the individual scholar.

By envisaging a PSM scholar as an 'engaged scholar' we have identified a set of *institutional* as well as discipline-based (PSM) *influencers.* These shape the conditions in which the various from of scholarship take place. Starting with the hope that the *tensions* that emerge out of this would result in 'creative tensions' we have ended up with a much more pessimistic and perhaps realistic view, namely that it is likely that we feel as 'stuck in the middle'.

Overall, there seems to be a discrepancy between requirements and opportunities, and the way by which these are rewarded. Current research methods in PSM are still biased towards quantitative methods such as survey studies and mathematical modelling. Participatory and collaborative are increasingly called for, but it is yet to be evident whether these have gained traction. However, scholars adhering to the more practitioner-oriented research, that ought to be for granted in an applied area such as PSM, are exposed to inconsistencies and misalignment between different requirements.

The paper identifies a range of inconsistencies and misalignments amongst requirements that are put on the individual researcher. These range from academic system (counting publications and assessment regimes that build on New Public Management that stand in stark contrast with e.g. academic citizenship and collegiality) through the requirements from the academic institution (teaching, networking, applying for funding, administration etc.) as well as the academic society (reviewer, editorials, organizations, conference arranger, grading committees etc. e.g. being an academic citizen) towards the society in large (increase competitiveness of national companies). In addition, the nature of PSM as an applied field, and the methodological range implied in engaged scholarship make this situation even more complicated for the individual researcher to act in.

Of course, we are not free of personal bias in this account. But we want to put this item on the agenda and have a dialogue with colleagues about how to become an engaged scholar.

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From Islands to Networks: Exploring Fragmentation in the SCF Ecosystem

Cristof Bals [a] & Lydia Bals [b, c]

[a] *Doctoral Student, Technical University Dortmund, Leonhard-Euler-Str. 5 D-44227 Dortmund, Germany, cristof.bals@tu-dortmund.de*

[b] *Professor of Supply Chain & Operations Management, University of Applied Sciences Mainz, Lucy-Hillebrand-Str. 2, 55128 Mainz, phone: 0049(0)6131-628-3293, Germany, lydia.bals@hs-mainz.de*

[c] *Visiting Professor at Department of Strategic Management and Globalization (SMG), Copenhagen Business School(CBS), Kilevej 14, 2. Floor,2000 Frederiksberg, Denmark; lb.smg@cbs.dk*

Summary

The SCF ecosystem and market dynamics of SCF have so far not been widely studied. This paper focuses on conceptual development of a SCF ecosystem view by building biomimicry research, thereby extending SCF adoption research to the broader SCF ecosystem. This paper argues that increased connectivity and intensified information flows, enabled through information technology, is the innovation at the center of the evolution of the SCF ecosystem. However, the fragmentation within the current SCF ecosystem is likely to hinder such further co-evolution and transparent information flow, and as a result is likely to limit its broader adoption. The current state of SCF ecosystem fragmentation will be compared to key principles from natural ecosystems in order to derive propositions on how SCF ecosystem fragmentation might be addressed.

Keywords: Supply Chain Finance, Ecosystem, Market, Transaction Cost Economics, Biomimicry

Submission category: Working paper

Introduction

Previously rather largely ignored in the field of supply chain management (SCM), financial flows in supply chains are increasingly getting into the center of attention in research and practice (Gelsomino et al., 2016; Liebl et al., 2016; More and Basu, 2013; Pfohl and Gomm, 2009; Wandfluh et al., 2015). To the backdrop of the last financial crisis, companies needed to find liquidity solutions in a context characterized by restricted access to capital (Caniato et al., 2016; Gelsomino et al., 2016; Liebl et al., 2016). The solutions created in response to this situation spurred the growth of the area of supply chain finance (SCF) (Gelsomino et al., 2016; More and Basu, 2013).

Currently, technological changes are reshaping the overall business ecosystem of which SCF is part. Ecosystem dynamics have been described by Moore (1993: 76) as follows: "In a business ecosystem, companies co-evolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations." As information technology is enabling greater connectivity and information flow, it can be argued to be the innovation at the center of the SCF ecosystem. This improved connectivity and increased flow of information (e.g. through platforms), is decreasing information asymmetry between actors and therefore

challenging existing business models (Ng, 2014; Fairchild, 2005). As a result, since SCF solutions basically are formed by information and financial flows between multiple parties, following a business ecosystem view is regarded as helpful to understand the evolution of SCF.

The SCF ecosystem and market dynamics of SCF have so far not been widely studied, with exception of Iacono et al.'s (2015) simulation of a SCF market. The current SCF ecosystem has, however, been described as limited in reach and fragmented in its implementation (Gelsomino et al., 2016; Iacono et al., 2015; Nienhuis et al., 2013). Fragmentation in the SCF market is mainly reflected by a high number of competing closed provider-specific platforms as well as varying formats and definitions (Nienhuis et al., 2013; Martin and Hofmann, 2017; Fairchild 2005). Consequently, the need for providers to agree on standards and collaborate has been identified as one of the central pre-requisites to improve the current situation and allow the SCF market to grow further (Nienhuis et al., 2013; Martin and Hofmann, 2017; Forum, 2016).

This paper focuses on conceptual development of a SCF ecosystem view by following a biomimicry lens, building on research into forest ecosystems (e.g. Simard et al., 1997, 2012), thereby extending SCF adoption research to the broader SCF ecosystem and seeking to derive propositions on how the SCF ecosystem fragmentation could be reduced and co-evolution be fostered.

Biomimicry as a concept is known mostly from R&D applications, where products are developed that emulate natural examples/archetypes, such as the well-known sticking patches developed from imitating gecko feet (Sivakumar, Balasubramanya & Sundaresan, 2012). But reaching beyond products, biomimicry also looks for insights on managerial processes and organizational issues: "Biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies. The goal is to create products, processes, and policies—new ways of living—that are well-adapted to life on earth over the long haul" (Biomimicry Institute, 2017).

The idea is that natural ecosystems exhibit certain properties in their structure and evolutionary process that can be of inspiration to the emergent SCF ecosystem. Thus the overall research question is: *Which principles from natural ecosystems and their evolutionary processes can help overcome the current fragmentation of the SCF ecosystem?*

The paper is organized as follows: The current SCF ecosystem will first be described. Next, key principles from natural ecosystems and their evolution will be summarized from literature. Finally, these two will be contrasted and compared in order to derive preliminary propositions on how SCF ecosystem fragmentation might be addressed.

The current SCF ecosystem

Coming back to Moore (1993: 76), it becomes clear that there is not just one single ecosystem at any time, but instead "[…] in any larger business environment, several ecosystems may vie for survival and dominance […] In fact, it's competition among business ecosystems, not individual companies, that's largely fueling today's industrial transformation." Following that insight, the business ecosystem perspective is dynamic instead of static. From studying these dynamics, Moore (1993) has identified four stages of ecosystem evolution – i.e. (1) Birth, (2) Expansion, (3) Leadership, (4) Self-Renewal (as shown in Figure 1).

SCF Ecosystem

The Evolutionary Stages of a Business Ecosystem		
	Cooperative Challenges	**Competitive Challenges**
Birth	Work with customers and suppliers to define the new value proposition around a seed innovation.	Protect your ideas from others who might be working toward defining similar offers. Tie up critical lead customers, key suppliers, and important channels.
Expansion	Bring the new offer to a large market by working with suppliers and partners to scale up supply and to achieve maximum market coverage.	Defeat alternative implementations of similar ideas. Ensure that your approach is the market standard in its class through dominating key market segments.
Leadership	Provide a compelling vision for the future that encourages suppliers and customers to work together to continue improving the complete offer.	Maintain strong bargaining power in relation to other players in the ecosystem, including key customers and valued suppliers.
Self-Renewal	Work with innovators to bring new ideas to the existing ecosystem.	Maintain high barriers to entry to prevent innovators from building alternative ecosystems. Maintain high customer switching costs in order to buy time to incorporate new ideas into your own products and services.

Figure 1 – Evolutionary stages of a business ecosystem (Adapted from Moore (1993))

Following the above stage model, the SCF ecosystem can be argued to currently be between stages (2) Expansion and (3) Leadership. Moore (1993: 79) characterizes stage 2 by two conditions, which are also present in the current SCF ecosystem: "[…] (1) a business concept that a large number of customers will value; and (2) the potential to scale up the concept to reach this broad market." This is reflected in the growing number of offerings and providers entering the SCF market. In addition to banks, new SCF providers include platform providers with different capabilities, such as multi-bank platforms (Liebl et al., 2016; de Meijer and de Bruijn, 2014; Martin and Hofmann, 2017; Nienhuis et al., 2013).

In comparison, the characteristics of stage 3 are not yet fully shown by the SCF ecosystem. Stage 3 is described as follows: "First, the ecosystem must have strong enough growth and profitability to be considered worth fighting over. Second, the structure of the value-adding components and processes that are central to the business ecosystem must become reasonably stable. […] It's in Stage 3 that companies become preoccupied with standards, interfaces, 'the modular organization,' and customer supplier relations" Moore (1993: 80). The necessity for stable components underlines the current lack of standards in SCF as identified by Martin and Hofmann (2017) as well as Fairchild (2005). E.g. "One problem in this context is the lack of standards when financial services are communicated. For instance, approved payables financing is also known as SCF or supplier financing. It can be offered as an early-payment product or a true-sale product. Therefore, it becomes difficult for customers to understand products and compare different services" (Martin and Hofmann, 2017: 54). And concerning the customer-supplier relationships: "Finally, the variety of FSPs increases the diversity of practices and applied platforms due to a lack of standardization. For instance, one supplier may be part of several different supply networks and consequently, multiple platforms. Hence, FSPs often neglect the need of standards when deriving service specifications" (Martin and Hofmann, 2017: 54).

Nienhuis et al., 2013 argue that it is this lack of standards as well as the missing collaboration between providers, which leads to the current fragmented state of the SCF ecosystem. They go on to argue that overcoming this fragmentation is needed to further grow the SCF market, benefitting all actors in the SCF ecosystem. But this requires a paradigm shift in thinking of providers. It can be argued that one of the barriers is the perceived benefit of customer "lock-in" to the provider. These "lock-in" effects can be seen as beneficial from a provider perspective (e.g. arising from the use of a proprietary platform) as they help retain customers and provide a basis for longer-term cross selling (Iacono et al., 2015; Silvestro and

Lustrato, 2014; Hofmann and Zumsteg, 2015). However, from a corporate client perspective, the same scenario is negative as it limits options and potentially competition on financing costs when binding a company to a particular solution and funding provider (Martin and Hofmann, 2017; Liebl et al., 2016).

The lack of standards has also been identified as a major issue by practitioners. In 2016 the International Chamber of Commerce (ICC) and various industry associations produced a joined whitepaper proposing standard definitions for SCF terms and products. In that whitepaper, they state: "The value of a standard global terminology around SCF extends beyond pure financial transaction considerations, to the realm of automation, dematerialization and technology**.** […] Whilst perfect consistency is unlikely given the diversity of SCF techniques, standard nomenclature will greatly facilitate the design, development and deployment of the supporting technology and web-based services for the SCF market. A lack of standards will impede these processes" (Forum, 2016: 19). Coming back to the optimization of information and financial flows, automation and digitalization of supply chains was highlighted in its importance by Caniato et al. (2016: 541f.) who found in their case studies that: "Several managers highlighted how the implementation of the most complex SCF solutions requires a complete digitalisation of the trade process." Therefore, we can conclude that standardization together with higher degrees of automation are key conditions to getting the SCF ecosystem to the next stage of maturity according to Moore (1993).

Toward the aspect of participants in ecosystems, within the business setting Manikas (2016: 93) defines a software ecosystem "[as] the software and actor interaction in relation to a common technological infrastructure, that results in a set of contributions and influences directly or indirectly the ecosystem. […] The activity of each actor is motivated by value creation both towards the actor and the ecosystem. […]. Moreover, each actor has one or several roles in the ecosystem. One role that can influence the ecosystem to a great extend is the orchestrator. The orchestrator is the actor or set of actors that are typically responsible for governing the ecosystem and support (and possibly promote) the actor and software interaction to the extend required to meet the ecosystem needs and principles." This highlights the importance of having a certain number and variety of actors within ecosystems, already from a business perspective. As will be explored next, actors are also a central theme in biological ecosystem research.

Biomimicry – learning from natural ecosystems

Within mature natural ecosystems efficient and effective (re-)usage of resources (e.g. water, minerals etc.) is ensured by members of the system occupying one or multiple of four roles: producers, consumers, scavengers and decomposers (Liwarska-Bizukojc, Bizukojc, Marcinkowski, & Doniec, 2009; Geng & Côté, 2002). Within natural ecosystems, primary producers are, for exempla, plants, consumers are predator animals, scavengers are animals that search and feed on carcasses and decomposers are the fungi and bacteria.

The authors propose that these roles can also be applied to the SCF ecosystem, where actors occupy multiple roles along the two main resource cycles of information and funds. For example, suppliers are producers of information (invoice) and consumers of funds. By contrast, banks are consumers of information (for risk assessment) and producers of funds. Multi-bank platform providers can be seen as a form of scavengers and decomposers, who collect, transform and distribute information and funds amongst parties as needed.

Turning toward the distribution of each role in mature natural ecosystems the producers, scavengers and decomposers are the majority, the consumers the minority (Geng & Côté, 2002). While the analogy might not translate 1:1 to the SCF ecosystem, it can be noted that currently there is a lack of scavengers and decomposers helping to facilitate the smooth flow of information and funds amongst all producers and consumers.

One example of how natural ecosystems use decomposers to maintain information transparency as well as coordination of material flows are the mycorrhizal fungi networks within forests. The mycorrhizal (the term for "root-fungus") fungi networks "gather nutrients from farther away and trade them with the plant for sugar, eliminating the need for the plants to develop extensive root networks" (Rade, 2015). In fact, the fungi provide the infrastructure for a lively two-way exchange of nutrients and information between different species of trees: "Mycorrhizal fungal networks [i.e. root-fungus networks] occur where mycorrhizal fungal mycelia [like a web of threads] link the roots of multiple plants, including those of different species, sometimes facilitating interplant transfer of carbon, nutrients or water" (Simard, 2009: 95).

Preliminary results and discussion

In order to arrive at a healthy SCF ecosystem reflected in the transparent, efficient end unhindered flow of information and capital to create value for all involved parties, the central principles emerging from this explorative study are: 1) Standardization, 2) ecosystem actor diversity, 3) modularity and 4) orchestration. Figure 2 summarizes them in a sequential manner.

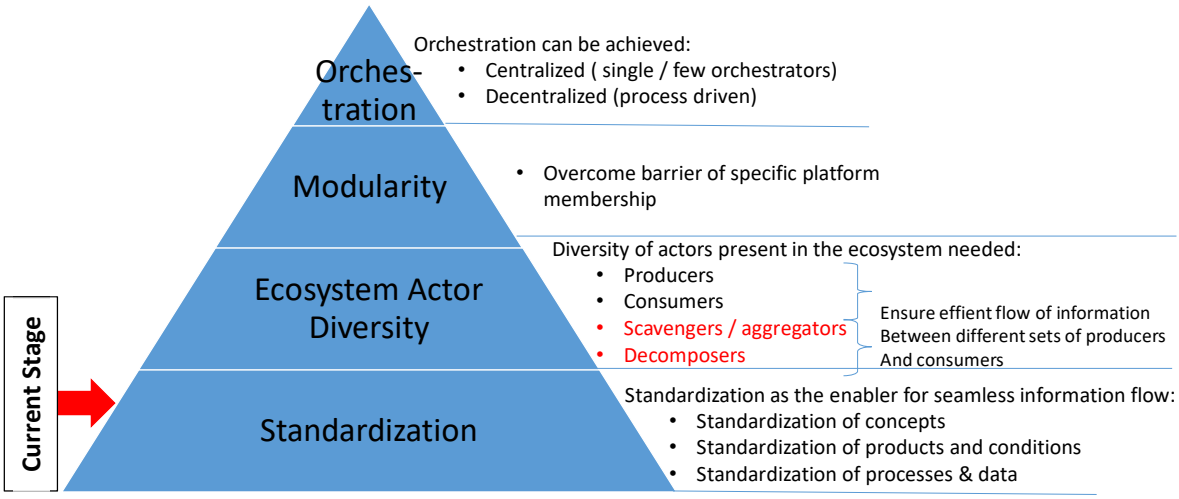

Figure 2- Pre-requisites for achieving ecosystem health & balance

As discussed earlier, standardization is a current challenge, while at the same time being the first precondition to further advance the SCF ecosystem. Standardization can be further differentiated into:

1) Standardization of concepts – agreed scope; definitions and terminology; value proposition etc.
2) Standardization of products and conditions – agreed parameters for a defined set of comparable offerings, which can be evaluated by customers
3) Standardization of processes and data – agreed parameters for a defined set of processes and data needed in order to provide the products.

As mentioned above, providers may not currently have incentives to invest resources into standardization if custom solutions are leading to a lock-in of customers, guaranteeing revenue vs. a vague promise of a larger market. Such a lack of transparency may hide the true impact of existing fragmentation and lock-in effects to customers (especially suppliers), not leading to them requesting a change in service. Moreover, complexities introduced by lack of standards in regulatory frameworks may further serve as inertia for providers to start collaborating on standards.

Thus, we propose:
Preliminary proposition 1: In order to evolve to stage 3, the SCF ecosystem needs further standardization across all three categories

Ecosystem actor diversity was highlighted from natural ecosystem research as a prerequisite of healthy ecosystems. With the vast majority of providers currently operating proprietary closed platforms, the current SCF ecosystem lacks such diversity.

Thus, we propose:
Preliminary proposition 2: In order to evolve to stage 3, the SCF ecosystem needs a higher diversity of actors

Leveraging the first two levels of Figure 2, modularity can be increased to better serve a broader customer base. Nienhuis et al., 2013 reflect the need for modularity by proposing a "4-corner model" of SCF where suppliers can freely choose providers and vice versa, thus overcoming the barrier of platform membership.

Thus, we propose:
Preliminary proposition 3: In order to evolve to stage 3, the SCF ecosystem needs more modular product offerings

Regarding orchestration, the central question emerging from this research is whether in future ecosystem orchestration will remain rather centralized, being performed by certain business, or – more similar to natural ecosystem – become decentralized. As Moore (1993:76) put in the context of business ecosystems: "Apple, IBM, Ford, Wal-Mart, and Merck have all been or still are the leaders of business ecosystems. While the center may shift over time, the role of the leader is valued by the rest of the community. Such leadership enables all ecosystem members to invest toward a shared future in which they anticipate profiting together." This resembles a centralized orchestration perspective. In nature there does not necessarily exist a single leader or a few particular leaders, instead it operates based on decentralized orchestration – as exemplified by the mycorrhizal fungi networks.

Thus, we propose:
Preliminary proposition 4: In order to evolve to stage 3, the SCF ecosystem needs improved (centralized or decentralized) orchestration

The next stage in this research will be to further substantiate and verify or falsify the preliminary propositions. With exploring the insights from natural ecosystems, we seek to contribute to research and practice bridging the currently fragmented SCF landscape towards a mature ecosystem.

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Purchasing and Supply Management (PSM) competencies today and in future: Taking stock and moving forward

Lydia Bals [a,b*], Heike Schulze [a, c], Steve Kelly [d], and Klaas Stek [e, f]
[a] *Mainz University of Applied Sciences, Lucy-Hillebrand-Str. 2, 55128 Mainz, Germany*
[b] *Copenhagen Business School (CBS), Kilevej 14, 2. Floor, 2000 Frederiksberg, Denmark*
[c] *London South Bank University, 103 Borough Road, London, SE10AA, United Kingdom*
[d] *Edge Hill University Business School, St. Helens Road, Orsmkirk, L39 4QP, United Kingdom*
[e] *University of Twente, Drienerlolaan 5, 7522 NB Enschede, the Netherlands*
[f] *Graz University of Technology, Kopernikusgasse 24/II. 8010 Graz, Austria*
**corresponding author; 004961316283293, lydia.bals@hs-mainz.de ;lb.smg@cbs.dk*

Abstract
Competencies in Purchasing & Supply Management (PSM) are the individual-level foundations of PSM performance. This paper takes stock of previous research and presents empirical results on current and future PSM competencies based on case study research. It categorizes PSM competencies according to Tassabehji and Moorhouse (2008)Tassabehji and Moorhouse (2008), and identifies changes over the last 10 years in the requirements for modern PSM practitioners. The work adopts a Knowledge-Based View (KBV) and differentiates PSM competencies as either explicit or tacit. The results provide insights for higher education curricula development and provides stimuli for competency model development and training in practice.

Keywords: Purchasing and Supply Management; competencies; knowledge-based view

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INTRODUCTION

Purchasing and Supply Management (PSM) plays a pivotal role in increasing overall organizational competitiveness. Considering that up to 60-80 % of their total costs, (Monczka et al., 2010; Van Weele, 2009) are external to the firm, i.e. being paid to suppliers, PSM's role in spanning organizational boundaries and managing these external networks has become increasingly important (Van Weele and Van Raaij, 2014).

While there exists a robust trajectory of research on skills, competencies and knowledge required in PSM (Cousins et al., 2006; Faes et al., 2001; Giunipero et al., 1999; Giunipero et al., 2005; Giunipero and Pearcy, 2000; Kern et al., 2011; Knight et al., 2014), a holistic assessment of the full competency base across a wide range of different PSM roles and different industrial settings is timely and it is this gap that this work seeks to address. In addition, although previous research has suggested the differentiation of tacit and explicit knowledge to be valuable in the PSM context (Giunipero et al., 1999), it has unfortunately not received enough attention to provide the basis for curricula or training design in higher education and/or practice, as well as for the selection of PSM personnel within organisations. This distinction is

discussed in more detail in the literature review, but in brief, tacit knowledge is that which is 'know-how', difficult to articulate and automatic and explicit knowledge, which is 'know-what' and describable in formal language in the form of manuals etc. (Smith, 2001). The importance of this distinction is relevant as it has implications for how organizations can most effectively harness, share and manage the knowledge of their employees in delivering increases in organizational performance.

There are recent developments that motivate to take stock of current and future competency requirements. Current challenges such as sourcing innovation (Schiele, 2010, 2012), handling potential supplier disruptions (Wieland et al., 2016), ensuring sustainability in the supplier network (Montabon et al., 2016; Schneider and Wallenburg, 2012; Wilding et al., 2012) and the implications of technology-based workplace changes in the wake of digitization are challenging previous assumptions about what will be sufficient competencies for the modern PSM professional. For example, with increasing automation, the question arises whether it is now enough to prepare students for a future career in PSM by merely conveying the textbook basics of purchase order processing or rather this education should include project-oriented learning on how to design processes and have them executed digitally with an advanced understanding of what IT can do for this field.

In the light of these developments and the need for generating further insights for research and practice alike, the research questions this study seeks to address are the following:

RQ1 – What current and future competencies/knowledge are necessary for PSM practitioners?

RQ 2 – How have the challenges of the modern PSM changed the competencies/knowledge required of PSM practitioners over the last ten years?

RQ3 – Which of these competencies/ knowledge are tacit/explicit?

Conceptual background

PSM Competencies

A PSM skills literature search resulted in an extensive list of skills and competencies found in 30 articles published from 1987 till 2017, shown in Table 1.

2007-2017	1997-2007	1987-1997
Baily et al. (2008)	Burt et al. (2003)	Anderson and Katz (1998)
Eltantawy et al. (2009)	Carr and Smeltzer (2000)	Carter and Narasimhan (1996)
Kern et al. (2011)	Cousins et al. (2006)	Cavinato (1987)
Knight et al. (2014)	Cousins and Spekman (2003)	Cruz and Murphy (1996)
Tassabehji and Moorhouse (2008)	Faes et al. (2001)	Dowd and Liedtka (1994)
Tatham et al. (2017)	Giunipero (2000)	Keough (1993)
Zawawi et al. (2014)	Giunipero et al. (2005)	Killen and Kamauff (1995)
	Giunipero and Handfield (2004)	Kolchin and Giunipero (1993)
	Giunipero and Pearcy (2000)	Murphy (1995)
	McKeefry (1998)	Pagell et al. (1996)
	Mulder et al. (2005)	
	Muller (2001)	
	Trent and Monczka (2003)	

Table 1: PSM skills literature 1987-2017

This work takes as its basis the work of Tassabehji and Moorhouse (2008). It has been chosen as the basis for the later comparative analysis in this study as it is the most elaborate categorised model and is in line with other research in the area, for example Tatham et al. (2017) and Killen and Kamauff (1995). Tassabehji and Moorhouse (2008) categorised procurement skills in 1) procurement specific skills and 2) generic management skills. This distinction is

also seen in the work of Killen and Kamauff (1995), Shou and Wang (2015) and Tatham et al. (2017).

Tassabehji and Moorhouse (2008) classify *Technical skills*, *Interpersonal skills*, *Internal and External enterprise skills* and *Strategic business skills* as described in Table 2, which cover both categories, procurement specific and generic management skills.

1	*Technical skills* (TS): Fundamental and basic administrative skills necessary for any procurement professional in the 21st century. They include product knowledge, computer literacy, total quality management and government legislation.
2	*Interpersonal skills* (IS): Necessary for interaction with people in teams and on an individual level including written and oral communication, conflict resolution, influencing and persuasion, group dynamics, leadership, problem solving and interpersonal and cultural awareness.
3	*Internal enterprise skills* (IE): These skills relate to the overall business and how the different functions interaction.
4	*External enterprise skills* (EE): These skills relate to the supply chain/network and its stakeholders.
5	*Strategic business skills* (SB): These skills relate to broader strategic issues and how procurement can impact on overall organisational value such as planning and managing strategic partnerships and alliances, risk management and adding value to the organisation.

Table 2: Introduction of a new taxonomy of procurement skills Tassabehji and Moorhouse (2008)

Theoretical background: Knowledge-based View

Knowledge within organisations has arguably become the most important source for competitive advantage, as organisations seek to harness the competencies and capabilities in a dynamic fashion and differentiate themselves from their competitors. Organisations are becoming increasingly focused on the creation, sharing and application of knowledge, as they have started to see the added value of assets other than capital, raw materials and labour, the effective management of which can lead to increases in organizational performance (Jasimuddin et al., 2005; Nonaka and Takeuchi, 1995; Smith, 2001). This shift in focus has "[...] stimulated a vast literature in the area of intellectual capital and intangible assets" (Elias and Scarbrough, 2004) and is key driver in the establishment of a Knowledge Based View (KBV) of organizations and the relevance of the field of Knowledge Management.

The KBV (Grant, 1996) is derived from the Resource Based View of the firm, which posits that a firm's competitive advantage is derived from the existence and management of tangible and intangible resources. If these resources are sufficiently differentiated by being valuable, rare, inimitable and non-substitutable, then these can be considered as core competencies and will result in varying levels and duration of competitive advantage will ensure (Hitt et al., 2013). An increasingly important intangible resource is knowledge (Grant, 1996) and in the field of supply chain management, this firm level view of resources has been expanded to also include external actors, such as suppliers (Dyer, 1996). Although in this study, the focus remains on firm level, the capability of managing and achieving value from suppliers is a key aspect of firm-based knowledge.

The third research question distinguishes between tacit and explicit aspects of knowledge, so it is necessary to briefly elaborate on the concepts of competency and knowledge as they are closely related and this work adopts the definition of 'competency' as "an underlying

characteristic of an employee (i.e., a motive, trait, skill, aspect of one's self-image, social role, or a body of knowledge) which results in superior performance" (Boyatzis, 1982) and that knowledge is "the understanding, awareness, or familiarity acquired through study, investigation, observation, or experience over the course of time. It is an individual's interpretation of information based on personal experiences, skills, and competencies" (Bollinger and Smith, 2001).

There are various approaches to managing, classifying and sharing knowledge, but many are based on a fundamental distinction between explicit 'know-what' and tacit 'know-how' (Nonaka and Takeuchi, 1995; Smith, 2002) and particularly the ease of transferability and aggregation of knowledge (Grant, 1996). Polanyi (1966) introduced the idea of tacit knowledge by stating: "we can know more than we can tell". Tacit knowledge is multidimensional, context-specific, and while it is often embedded within organizational routines (Kothari et al., 2012) and can only be observed through its application and acquired through practice, which means its transfer between people is slow, costly, and uncertain (Kogut and Zander, 1992).

The importance of tacit knowledge is high. There is proof that approximately 90 % of all knowledge in organizations is tacit (Smith, 2001). Conversely, explicit knowledge is that which can be articulated in formal language, like manuals, mathematical expressions, copyright and patents (Smith, 2001) and can be shared more easily between people (Grant, 1996). Explicit knowledge has even "the character of public goods" (Tamer Cavusgil et al., 2003). Jasimuddin et al. (2005) summarize: "Tacit knowledge is less vulnerable but less accessible by legitimate organisational users, whilst explicit knowledge is more accessible but also more vulnerable to illegitimate exploitation".

Although the distinction between tacit and explicit knowledge can be presented as being a clear cut dichotomy, there is evidence that knowledge exists in the continuum between both ends: between strict tacit and explicit knowledge (Jasimuddin et al., 2005; Nonaka & Von Krogh, 2009). The most common route to tacit knowledge lies in sharing experiences: "Without some form of shared experience, it is extremely difficult to project her- or himself into another individual's thinking process" (Nonaka & Takeuchi, 1995). However, tacit knowledge can also be codified and can shift to explicit knowledge (Nonaka & Takeuchi, 1995). This research classifies competencies according to the scheme established by Tassabehji and Moorehouse, taking into account whether they are tacit or explicit in nature (see Table 8).

In order to ensure that explicit and tacit knowledge is positioned in a relevant context, which provides something meaningful to practitioners and a robust contribution to the literature, the research model was developed from the relevant academic literature. The model shown in the Appendix served as the basis for the interview guide development in preparation of the data collection.

Methodology

Research Design

As discussed in the introduction, the overall purpose of this work is to provide an updated perspective on which PSM competencies are required now and in future and differentiate between which of these are tacit and explicit in nature. In the development of the research design, a qualitative data collection approach was deemed most suitable in order to allow for emergence of competencies outside of a predefined list based on previous research, i.e. directly using the Tassabehji and Moorhouse (2008) framework as pre-defined interview or survey areas of focus. In analysing the approaches for case study research for the topic at hand, the research team followed the decision tree of Ketokivi and Choi (2014) and concluded that the KBV would provide a suitable theoretical foundation for this research. Due to the exploratory nature of the research, the overriding goal was to deploy KBV in the context of PSM rather than testing any hypothesis based on it. Other theories considered initially were

Human Capital Theory (e.g. Osterman, 1987) and the Resource-based View (e.g. Barney, 1991; Wernerfelt, 1989).

Assurance of research quality criteria 1) credibility/internal validity, 2) transferability and generalizability/external validity, 3) dependability/reliability and 4) confirmability/objectivity was addressed by the use of a number of techniques (based on Lincoln and Guba, 1985; Riege, 2009; Salzberger and Sinkovics, 2006; Salzberger et al., 1999; Welch et al., 2002; Yin, 2013). For each major project phase, i.e. preparation, implementation, follow-up and dissemination, the specific measures to be applied were defined during March/April 2016, and then continuously reviewed and refined over the course of the data collection.

Case Study Research: Case Selection, Data Collection, and Analysis

Collecting qualitative data through the use of structured interviews, based on the research model (Appendix) ensured that a full and deep understanding of the phenomenon could be obtained. This is particularly important in tacit areas of knowledge, that are often more difficult to articulate and could therefore be developed through questioning. A selection strategy for the case companies was deployed to cover the following organizational characteristics and to allow for the widest possible perspective of different requirements. Industries with lower and higher external value added; also two major consultancies to hear their view on PSM's current and future knowledge requirements across their client base), geographical spread (to not overemphasize one particular national culture), and conventional (i.e. commercial) business models versus at least some social businesses (to challenge current PSM conventions). This led to a final selection of 12 overall cases, ranging at the higher end of the usual suggestion of having between 4-10 cases (Eisenhardt, 1989). Resulting details of the case company selection demographics are briefly outlined in Table 3. All companies had some international scope in their operations.

Within each case company the basic interviewee target sample included the Chief Procurement Officer (CPO) or a senior level PSM representative, a PSM employee responsible for strategic sourcing, as well as a PSM training/HR representative. In addition, some companies provided access to an even broader interviewee base, which followed our intention to cover the full procure-to-pay process (a process description was used to discuss potential interviewees before scheduling the interviews). Some of the smaller companies put forward a single interviewee, who, because of the role he/she had, was able to cover all PSM areas. In several cases it was possible to also obtain an interviewee at a supplier of the case company to obtain the buyer-supplier dyad perspective on required knowledge for a successful business relationship. In total, this yielded 12 case companies (including 4 buyer-supplier dyads, so 16 different companies in total) and 46 interviews.

All interviews were recorded and transcribed. The data analysis was done by four researchers, who jointly performed the coding in the qualitative data analysis software NVivo 11. At the beginning of the coding process, the researchers jointly coded the same interview to get accustomed to the approach and to become aware of any individual differences. An initial coding protocol was to use a pre-defined coding tree based on existing literature, but subsequent review suggested that an in vivo, or indigenous coding (Bazeley and Jackson, 2013) was more suitable to ensure that they were not overly fixated on certain categories of competencies . The coding team had regular discussion meetings and created a common reference document that captured an agreed consensus on how to approach certain nodes in a standardised manner. To ensure and increase the inter-coder reliability (i.e. how similar the coding between coders was) in NVivo 11, in the first discussion meeting a joint review of one commonly coded transcript was conducted. This also ensured consistency of the use of individual nodes in the coding process, for example through showing that an individual had coded 'willingness to work' under

'passion'. In addition, it helped to ensure a transparent and traceable qualitative data analysis approach (e.g. Bazeley, 2013). Once the initial joint review and discussions of the first interview coding was finalized, coding pairs were formed for all further coding activities. Thus, all interviews were coded by two researchers to ensure broad node coverage and to enhance the coding process reliability. Each coder continuously updated the common reference document and passed it on to the next coder, thus facilitating inter-coder consistency.

Case	Sector/Industry	Interviewees	Business Model	No. of Employees	Turnover in €*
AUTO1	Automotive	10 + 2 (supplier side)	Traditional	> 300 000[1]	>70 billion[1]
AUTO2	Automotive	1	Traditional	80 000 - 99 999	>10 Billion[1]
CHEM1	Chemicals	2 + 1 (supplier side)	Traditional	10 000 - 49 999[1]	> 5 billion[1]
CHEM2	Chemicals	6	Traditional	10 000 - 49 999[1]	>10 billion[1]
CONSU1	Consulting	2	Traditional	> 300 000[1]	>20 billion[1]
CONSU2	Consulting	1	Traditional	1 000 - 9 999[2]	>1.0 billion[2]
TECH1	Technology, Electronics	1	Social Business	< 999	n.a.
TECH2	Technology, Electronics	1	Traditional	< 999 [4]	>10 million [4]
CONST1	Construction	3 + 1 (supplier side)	Traditional	10 000 - 49 999[3]	>1 billion[3]
FOOD1	Food	9 + 1 (supplier side)	Traditional	80 000 - 99 999	>20 billion[5]
PHARM1	Pharma	3	Traditional	50 000 - 79 999[1]	>10 billion[1]
SOCSER1	Social Services	2	Social Business	< 999 [4]	>2 million [4]

Legend: *Exchange rates 31.12.15; [1]based on companies' annual reports 2015; [2]Data from 2014 based on company homepage; [3]Data from 2015 based on company homepage; [4]Data based on expert interview; [5]Data based on Forbes.

Table 3: Case Company Demographics.

Findings and Discussion

Current and Future Competencies

PSM practitioners identified a total of 65 current competencies, which they felt were currently necessary for them to meet their organizational objectives. These were ranked by the number of instances that they were coded in the various interviews and the top 10 of the 65 current competencies are shown in Figure 1 on the left. "Negotiation" was coded with the highest number of instances. Besides, when grouping competencies into those that share similar characteristics, then the remaining competencies in this list reflect those that are related to communication and relationship ("Communication skills", "Interpersonal communication", "Stakeholder Relationship Management"), or to strategic and analytical ("strategic thinking", "analytical thinking", "strategic sourcing"), or to professional knowledge requirements ("Basic knowledge on PSM role & processes", "cross-functional knowledge"). Firstly, this shows that there is a clear mix of competencies that are required to be successful as a buyer or manager in PSM and also a link between some these competencies were stressed. Of particular relevance to those involved in an academic or training role, is that a PSM curriculum or training program needs to reflect all of these areas, which may need to be taught using different training methods. For example, classroom or web-based learning for professional knowledge and more social learning or non-traditional techniques for communication and relationship areas.

PSM practitioners mentioned a total of 56 competencies, which they felt would be necessary for them to meet their organizational objectives in the future. These were ranked by the number of instances that they were coded in the various interviews and the top 10 of the 56 future competencies were shown in Figure 1 on the right.

These competencies reflect areas of growing interest and concern for both PSM practitioners and the wider organizational context. There are a number of competencies that relate to the broader digitization agenda (e.g. "eProcurement Technology", "Automation", "Big Data Analytics" and "Computer Literacy") and the high ranking of "Sustainability" establish its increasing importance in the modern industrial context. However, interviewees expressed uncertainty on exactly what specific competencies would need to be developed in PSM practitioners and students to meet these requirements. Although the correlation with competencies that also were given a high priority in future PSM, such as "Holistic Supply Chain Thinking" or "Strategic Thinking", might give an indication as to how these areas can be further broken down into manageable areas. Four competencies were shared in both current and future views, i.e. "Analytical Skills", "Strategic Sourcing", "Strategic Thinking" and "Sustainability". It is therefore important that these form a coherent thread through any training or educational programs. The overall findings regarding frequencies of coding are shown in Table 4. The green color indicates commonality between current and future competencies.

Current Competencies	Future Competencies
Analytical skills	Analytical Skills
Basic knowledge on PSM role & processes	Automation
Communication skills	Big Data Analytics
Cross-functional abilities & knowledge	Computer Literacy
Interpersonal Communication	eProcurement Technology
Negotiation	Holistic supply chain thinking
Stakeholder Relationship Management	Process optimisation
Strategic sourcing	Strategic Sourcing
Strategic thinking	Strategic thinking
Sustainability	Sustainability

Table 4: Top 10 *current* and *future* competencies for PSM, in alphabetical order

Clustering Results

The coded competencies were grouped thematically. The cluster categories are based on Tassabehji and Moorhouse (2008), as introduced in the conceptual background.

Table 5 shows the mapping of the competencies to these clusters. Many of the nodes were very similar or the same as in the overview provided by Tassabehji and Moorhouse (2008), thus were easy to allocate; the others were clustered by the research team based on a careful review and agreed decision. The competencies marked in grey were only mentioned in the context of current competencies and the blue ones were mentioned only related to the future. The black ones were mentioned in both contexts. Newly added competencies are marked in bold and italics.

Technical Skills	Interpersonal Skills	Internal/ External Enterprise Skills	Strategic Business Skills
Automation (NEW)	Ability to Make Decisions	Change Management	Business Acumen
Basic knowledge on PSM role & processes	Analytical skills	Communication skills	***Critical thinking (NEW)***
Big Data Analytics (NEW)	Conflict Resolution	Cross-functional abilities & knowledge	Financial acumen
Computer Literacy	Creativity	Engineering	***Holistic Supply Chain Thinking (NEW)***
Contract Management	***Curiosity (NEW)***	Finance	PSM Best Practice Intelligence Scouting
Cost savings	***Deal with ambiguity (NEW)***	Logistics	Risk management
eProcurement Technology	Effective questioning techniques	Manufacturing/ Production	Strategic thinking
Innovation sourcing (NEW)	Humbleness	Marketing	***Sustainability (NEW)***
Innovative sourcing approaches (NEW)	***Integrity (NEW)***	Quality (QHSE)	
Intellectual Property	Interpersonal Communication	R&D	
KPI Reporting Design	Knowledge sharing	Supply Chain	
Languages	Leadership	Sales	
Negotiation	Learning agility	Cultural awareness	
Process optimization	Mobility	Customer Focus	
Product knowledge	***Openness, Open-minded (NEW)***	Networking	
Project Management	***Passion (NEW)***	Stakeholder Relationship Management	
Quality assurance	Prioritization	Supplier management	
Strategic sourcing	Remote_Virtual Working		
Tools and Systems Implementation	Resilience		
	Results focus_driving for results		
	Self confidence (NEW)		
	Self-reflection (NEW)		
	Self-reliance (NEW)		
	Structured way of working		
	Teamwork_working in teams		
Remark: Employer Branding subsumed under communication			

Table 5: Competency Clusters (Grey: Only Current, Blue: Only Future, bold & italics: newly added based on case study research

In the overall clustering, the technical skills dominate, followed then by interpersonal skills, internal/external enterprise skills and strategic business skills as can be seen in Table 6.

1 : TassabehejiMoorhouse_1_*Technical skills*	1012
2 : TassabehejiMoorhouse_2_*Interpersonal skills*	739
3 : TassabehejiMoorhouse_3_*InternalExternal enterprise skills*	632
4 : TassabehejiMoorhouse_4_*Strategic business skills*	593

Table 6: Competencies Analysed by Clusters.

This order of how often one of the clusters was mentioned was relatively consistent across industries. In all of them the technical skills were the most often mentioned, only the other three clusters varied slightly. It is moreover interesting to note that interviewees from the supplier side slightly emphasized the strategic business skills more than the PSM professionals themselves.

Which of these competencies/knowledge areas are Tacit/Explicit?

The first part of this analysis takes the list of both *current* and *future* competencies/knowledge and uses the characteristics provided by Smith (2001) as a way of distinguishing them as being either explicit or tacit in nature. The Top 10 current and future competencies, which were referred to the most times in the interviews (number of instances), are shown in the table below along with whether they are explicit or tacit in nature.

Current Competency	Explicit/ Tacit	Future Competency	Explicit/ Tacit
Negotiation	T	Sustainability	T
Communication skills	T	eProcurement Technology	E
Interpersonal Communication	T	Automation	E
Sustainability	T	Holistic supply chain thinking	E
Analytical skills	E	Big Data Analytics	E
Strategic thinking	T	Strategic thinking	T
Strategic sourcing	E	Computer Literacy	E
Stakeholder Relationship Mgmt.	T	Analytical Skills	E
Basic knowledge PSM role & processes	E	Strategic Sourcing	E
Cross-functional abilities/knowledge	E	Process optimisation	E

Table 7: Top 10 Current and Future Competencies – Tacit and Explicit, ordered by number of codings.

When clustered according to Tassabehji and Moorhouse (2008), the picture shown in Table 8 emerges for current and future competences.

	Current Competencies_TACIT	Future Competencies_TACIT
1 : TassabehjiMoorhouse_1_*Technical skills*	318	71
2 : TassabehjiMoorhouse_2_*Interpersonal skills*	507	115
3 : TassabehjiMoorhouse_3_*InternalExternal enterprise skills*	436	100
4 : TassabehjiMoorhouse_4_*Strategic business skills*	329	186
	Current Competencies_EXPLICIT	Future Competencies_EXPLICIT
1 : TassabehjiMoorhouse_1_*Technical skills*	652	266
2 : TassabehjiMoorhouse_2_*Interpersonal skills*	196	76
3 : TassabehjiMoorhouse_3_*InternalExternal enterprise skills*	212	55
4 : TassabehjiMoorhouse_4_*Strategic business skills*	260	86

Table 8: Analysis of Competency Classifications

Of the top 10 *current* competencies, 6 were identified as tacit and 4 were explicit, therefore demonstrating the key role that tacit competencies play in ensuring that PSM professionals and the PSM function can meet their objectives. Further, although 6 out of the 10 Top 10 competencies were tacit, they form the top 4 ("Negotiation", "Communication Skills", "Interpersonal Communication" and "Sustainability") therefore further underlining their importance. Therefore, those involved in the education and recruitment of both new and existing PSM staff need to factor these tacit competencies into decision making in these areas of activity. Although explicit competencies can far more readily be imparted through formalized and didactic education methods (e.g. lectures), tacit areas often need to make use of different and non-traditional methods, for example, mentoring and practice-based learning. Whilst these methods may be more challenging for both educators and students alike, not adopting them may mean that these tacit competencies are underdeveloped.

In addition to the educational aspect of imparting tacit knowledge, it is also more difficult to share intra-organizationally than explicit knowledge, as it is less codifiable, being more difficult to articulate. As the tacit dimension is so important, knowledge sharing between individuals and within a function needs to reflect this and be prioritized accordingly. This means that aspects of socialisation (as per Nonaka & Takeuchi, 1996) such as mentoring and buddying need to be become integral parts of work practices to ensure that tacit knowledge can be articulated and shared in the most effective manner. Although Standard Operating Procedures (SOPs) and manuals undoubtedly serve a useful purpose in providing consistency of work

practices, they are not best suited to the full sharing of tacit knowledge. This means that such documentation should be seen as the start point of any training and education and not as the sole method of imparting knowledge.

The second part of the analysis follows the approach as above for current competencies, but now looks at whether the *future* competencies identified in the interviews are tacit or explicit in nature. When looking at *future* competencies, 2 were deemed tacit and 8 were explicit, although the top competency listed was tacit in nature ("Sustainability"). This shows a different balance than that found when current competencies were analysed and tacit competencies were deemed as being of overall more importance. This shift in emphasis between explicit and tacit aspects, can perhaps be explained by to the ease through which explicit knowledge can be articulated and those competencies that have yet to materialise may be more challenging to articulate. Nonetheless, as the majority of these future competencies are explicit in nature, there is an opportunity for explicit based training (both in-house and in education settings) to be developed and delivered in the present to ensure that PSM practitioners are best equipped to develop these future requirements. The demographics data has been used to generate a number of different insights, all of which cannot be covered in this working paper, but some of the key differences between groups are discussed here to provide these insights.

Firstly, when the differences in job role (Management, Operative and HR/Training Representative) are applied to *explicit* competencies, although a considerable degree of similarity was seen across the different job roles, the HR/Training Representative did not identify the "eProcurement" competency as being of importance, yet the Management and Operative role did. Therefore, as it is often the responsibility of the HR/Training Representatives to organize any in house training programmes, these need to ensure that "eProcurement" is adequately represented as this could lead to a potentially important gap. In addition, "Supplier Management" was not listed in the Management role, but was specifically in the Operative, which is not necessarily surprising, as it would be a more operational task to focus on direct dealings with suppliers. However, those in a Management role, whilst, of course, focusing on "Leadership" etc., should not overlook the key aspect of "Supplier Management" and ensure that they maintain dealings with suppliers, therefore getting a clear view of the to the supply market and current and future challenges that may arise.

When a similar view of *tacit* competencies across job roles is taken, there is a mismatch between "Languages", which was highly ranked by the Operative role, but not in the Management or HR/Training Representative lists. As those in Management roles would tend to be more experienced, they may have had chance to develop their "Languages" skills more fully and also, their more senior level may require them to deal with inter-organisational counterparts who have similar levels of "Languages" skills. This may not be the case for those in Operative roles, who tend to be less experienced and more likely to be dealing with the operational level of suppliers and therefore they may see "Languages" as a more immediate and regular challenge. This need highlights the importance of integrating schemes such as the ERASMUS Mobility Programme into HE curricula and also that organisations themselves should consider internships or exchange programmes with PSM parts of their organisation in different countries or supplier exchange programmes.

When looking at *current* and *future* tacit competencies by years of total work experience, "Conflict resolution" is seen as not being important for the "lower" years' work experience of 3 to 5 and 6 to 10 year groups, but is however ranked highly in the other higher year categories. This would therefore suggest that this is an importance competency later in a PSM career and could be integrated into Masters level HE curricula and/or more advanced in-house training programmes. Also of note, was that "Communication" was a key competency for all year groups apart from the 3 to 5 year bracket and, as this is a key (2nd ranked in Current Competencies), it may warrant a focus at all stages of education and training.

Conclusions, limitations and suggestions for future research

Our contribution to the academic literature is through the analysis of current and future individual competencies required for PSM, identifying differences and similarities from work done ten years ago and then differentiating these into tacit and explicit areas. Based on a combination of a systematic literature review and coverage of 16 case study firms, we updated the PSM competency landscape according to the classification by Tassabehji and Moorhouse (2008). Our research refers to the theoretical basis of the Knowledge-based View (KBV) that outlines the importance of individual competencies and knowledge for PSM and company performance. Guided by the 3 research questions ("1. What current competencies/knowledge are necessary for PSM practitioners?", "2. How have the challenges of the modern PSM changed the competencies/knowledge required of PSM practitioners over the last ten years?" and "3. Which of these competencies/ knowledge are tacit/explicit?"), a case study approach was followed, comprising interviews with 46 PSM practitioners representing either a managerial, operative or Training/HR role, in various companies across a broad range of industries located in different countries. The 65 current competencies and the 56 future knowledge areas identified by coding the interviews were classified into *explicit* knowledge in the meaning of 'know-what' and *tacit* knowledge capturing the 'know-how' (e.g. Grant, 1996; Nonaka and Takeuchi, 1995; Smith, 2002) Polanyi (1966).

To cluster the competencies, we used the categorization of Tassabehji and Moorehouse (2008). Based on this analysis, we suggest that a new category of competencies, i.e. meta-competences (Le Deist and Winterton, 2005), including such coded competences as "learning agility", "curiosity" and "self-reflection", is required. This may help to keep competencies up-to-date for the challenges of the modern PSM.

Overall, the results can be summarized as follows. The PSM professionals indicated that the current competency profile for PSM encompasses a range of knowledge areas. Besides "Negotiation", competencies regarding communication and relationship management (e.g. "Interpersonal communication"), strategy and analytics (e.g. "Strategic thinking") as well as professional knowledge requirements (e.g. "Basic knowledge on PSM role & processes) are perceived to be required for a successful buyer or manager in PSM. The majority of these knowledge areas are classified to be tacit.

When looking at future competencies, additional knowledge was identified to become important, especially in the area of "Sustainability" and "Digitization" (e.g. "eProcurement Technology", "Automation"). More future competencies are in the explicit knowledge area. The main limitation of this research lies in the restricted number of interviewees and companies. A broader empirical validation of the findings is suggested.

The findings of this research have various educational and managerial implications. First, academic PSM education as well as professional PSM qualification need to reflect the broad range of competencies that was identified. Taking into consideration the mix of explicit and tacit knowledge areas, different teaching methods should be applied. Methods like social learning or problem-based learning probably need to be more incorporated in PSM training programs. Companies should reflect the importance of tacit knowledge in their concept and their tools for intra- and inter-organisational knowledge transfer. Also, when it comes to educational training of professors and teachers, a pedagogy that encompasses a greater balance between tacit and explicit as well as meta-oriented competencies is required.

Second, academia as well a management needs to reflect "Sustainability" as well as "Digitisation" in their educational programs. Further research opportunities are seen in a breakdown of competencies and knowledge in these areas. Also, the finding that competencies related to digitisation are more explicit in nature invites further investigation.

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Digital Transformation in Procurement: The Need for Change Management

Laura Berger [a,*], Michael Henke [a]

[a] *TU Dortmund University, Leonhard-Euler-Str. 5, 44227 Dortmund, Germany*

[*] *Corresponding author* berger@lfo.tu-dortmund.de

Summary

This paper deals with summarising the trends and future requirements in Purchasing & Supply Management (PSM) related to digitalisation based on existing studies, papers and interviews. It outlines the consequences of digital transformation on purchasing departments and processes of organisations and requirements in order to keep or increase the importance of PSM in companies. Furthermore, the paper focuses on deriving the need for change management in PSM to cope with these challenges and gives an outlook on different change dimensions and their setup, always focussing on the roles of human beings and their preparation for future tasks and working environments.

Keywords: digital transformation, change management

Submission Category: Working paper

Introduction and Motivation

Business environments constantly underlie changes that organisations have to face and develop accordingly in order not to fall behind in times of Industry 4.0 and digitalisation, where fast adaption to new developments and reaction to this transformation is indispensable (Valenduc and Vendramin, 2017). Digitalisation, individualisation and increasing autonomy as basic principles of Industry 4.0 have extensive impact also on Purchasing and Supply Management (PSM) (Pellengahr, Schulte, Richard and Berg, 2016). Organisations and their activities, tasks and orientation are especially affected by lots of these developments.

Digitalisation stands for a combination of new technologies (Bounfour, 2016). It is the connection of processes and products as well as of the physical and virtual world (Demary, Engels, Röhl, Rusche, 2016). Transformation describes the decision to restructure a system in order to create competitive advantages and secure them sustainably. Business transformation is a holistic approach with the objective of developing new business models and empowering change processes (Schwenker and Hanßen, 2009). Digital transformation means new developments in the use of digital artefacts, systems and symbols within and around organizations. It is a continuously executed, technical and internet-based, disruptive transformation process. The competitive position of a company is sustained or extended by the use of modern technology. Digital transformation can affect all areas of a company: strategy, business models, processes, structures, culture. Besides the business environment, digital

transformation affects the whole society as well. (Bounfour, 2016; Schallmo and Rusnajk, 2017; Wallmüller, 2017)

The open outcome of the transformation is characteristic, as frame conditions can change very quickly and constantly during times of digital transformation. A framework adapted to the challenges of digitalisation is needed (Barghop, Deekeling and Schweer, 2017). In this study, the digital transformation stands for the impacts of technical developments on the business and working environment and all changes and new challenges arising with these. This paper focuses on how digital transformation affects Purchasing & Supply Management (PSM) and how companies need to take action in order to enable procurement staff to deal with the profound changes.

Profound changes and their effects on processes, organisations and people are the motivation for managing these developments and their consequences which means to initiate a structured change management approach. Change Management research started in the 1950s as a medium- to long-term process focusing internal changes with the goal of maximising effectiveness and efficiency of a transformation (Hartwich, 2011). Objectives, strategies as well as processes and structures of organisations are adapted to changing conditions (Kreutzer, Neugebauer and Pattloch, 2017). The process is supposed to be accompanied and accepted by the workforce (Cacaci, 2006; Rank and Scheinpflug, 2010). The change management process understanding in this paper underlies the fundamental research by Lewin, 1951, and Kotter, 1995.

When paying particular attention to the role of the human being in PSM related functions of an enterprise it comes to establishing appropriate human-centred change management in order to accompany the employees through the digital transformation. This paper points out possible implementation of change management, focussing on restructuring of processes, preparing and qualifying procurement staff and impact on the organisation of PSM function and departments as well as implications for the whole company and its roles in networks.

The research goal is to develop a framework that shows trends and possible future developments caused by digitalisation, how they lead to changed or new requirements for people in PSM (e.g. tasks, competences) and how companies can cope with the transformation using change management methods. This working papers' conceptual study forms a starting point for this greater endeavour. There is no literature available yet focusing directly on change management in PSM due to digital transformation. The paper derives recommended action in terms of building up digital and other related competences for the companies that face respective developments in the framework of structured change management and digital transformation procedures. The comparison of traditional change management phase models with the process of a digital transformation gives an indication of a set-up for configuring the procedure of the digital transformation in PSM accompanied with relevant change management approaches.

In the following sections, the methodological approach of this study is shortly characterised. Moreover, the results section summarises how the digital transformation effects PSM. A comparison of digital transformation, changes and challenges in PSM and applicable change management process steps is conducted.

Methodology

Firstly, the main impacts and related challenges for PSM caused by the digital transformation are summarised. Therefore, a number of up-to-date studies and articles are analysed which describe the trends and current developments in procurement. In addition, in the context of the EU project Purchasing Education and Research for European Competence Transfer (PERFECT) interviews with PSM practitioners were conducted (Project PERFECT, 2017). The core statements of the 41 interviews in the context of trends and digitalisation aspects discussed in the job environments and the arising challenges are evaluated.

The subsequent comparison of change management triggers with the situation of digital transformation in PSM and its effects mainly on the human factor leads to the need of a change management approach for exactly these challenges. It is argued why the implementation of tailored change management in PSM organisations makes sense in times of digitalisation. The phases of a digital transformation and change management are integrated with the trends in PSM as a concrete use case.

A business transformation process can be divided in four dimensions (Reineke and Bock, 2007):

1. Reframing: the process of changing the position of the company regarding its self-perception and own opportunities.
2. Restructuring: the process of restructuring the company in order to achieve a competitive performance level.
3. Revitalizing: the process of revitalisation in order to generate growth.
4. Renewing: renewing of the human part of transformation in order to increase motivation and enable the acquirement of new skills.

These dimensions are used to structure the digital transformation of PSM in this conceptual study. They partly resemble the change management phases by Lewin (unfreeze – move – defreeze). The change management concept to be developed bases on Lewin's and Kotter's process steps representing the most relevant and most frequently cited change management models. In future research, other models will be considered as well. Lewin developed the classic three phases model that is regarded as the fundamental model in literature. Kotter splits Lewin's three phases into more detailed steps of a change process, as visualised in **Figure 1**. Therefore, there is a connection between these two models. They are both linear approaches with process orientation. Kotter improves the involvement of employees and is less rigid in his steps. (Kotter, 1995; Lewin, 1951)

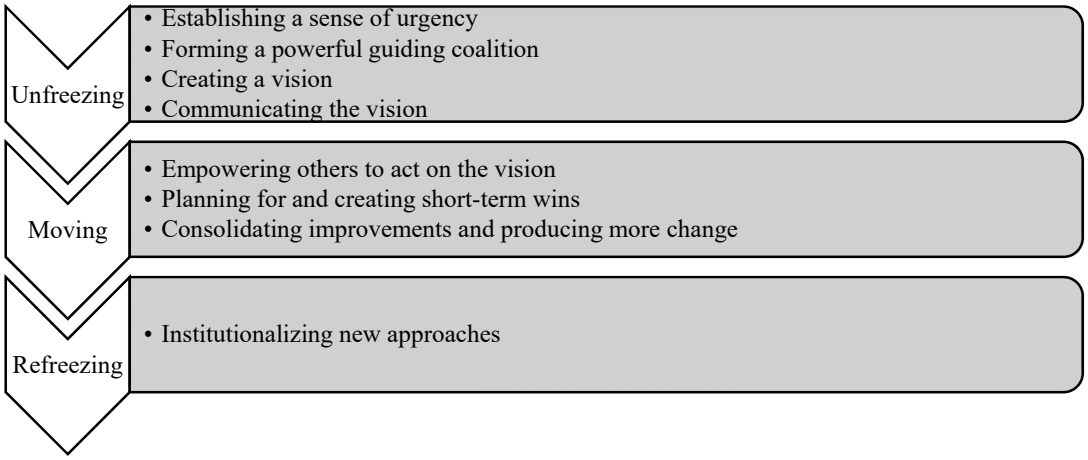

Figure 1: Integration of Change Management models by Lewin and Kotter (own illustration, adapted from Kotter, 1995; Lewin, 1951).

Results

Digital transformation in PSM

A number of up-to-date studies and articles describe the trends and current developments in procurement. They do all point out digitalisation as one of the main aspects influencing the future position of Purchasing & Supply Management (PSM) and the roles of purchasers (e.g. Kushner, 2015; Nowosel, Terrill and Timmermans, 2015; Pellengahr et al., 2016; PricewaterhouseCoopers, 2014). In addition, in the context of the EU project Purchasing Education and Research for European Competence Transfer (PERFECT) interviews with PSM practitioners were conducted. One of the main results of the interview analysis is that digitalisation and linked new requirements are one of the biggest challenges for modern procurement (Project PERFECT, 2017).

PSM is involved in digital transformation on different levels, each demanding different special adaptions within enterprises and PSM departments. On the one hand, digitalisation is represented by new categories. Firms purchase digital products, services, and hybrid components. Buyers must have reliable product knowledge about their new digital procurement portfolio, e.g. about quality and pricing. In order to acquire the demanded technical expertise, it is even more important to collaborate with other company functions. Purchasers have to be involved early in product development processes. New categories will have to be procured with new sourcing strategies while others might lose importance or even disappear from the purchasing portfolio. PSM confirms its strategic role by gaining additional knowledge and networking as an equal partner. (Arnolds, Heege, Röh and Tussing, 2016; Pellengahr, et al., 2016; PricewaterhouseCoopers, 2014; Schuh, Aghassi, Bremer and Graw, 2014)

On the other hand, digital transformation causes not only technological advances and new requirements but also organisational and process-related changes. The administrative purchase-to-pay process will mostly be automated, as digital technologies help facilitating. Further automation of transactional procurement (advanced eProcurement technology solutions)

decreases involvement of employees in purchase-to-pay and releases more personal resources for strategic tasks and relationship management (Kushner, 2015; Pellengahr et al., 2016; Scharlach, Schuh and Strohmer, 2014). Furthermore, digitalisation plays an important role for establishing systems and networks, connecting partners and integrating supply chains (Drake, 2012). Humans, machines, products, customers and other stakeholders are more and more connected and communicate with each other with the help of the Internet of things (IoT) and digital solutions. The traditional silo mentality has to be reduced further. Business processes become integrated in vertical direction as well as horizontal towards suppliers and customers; data is stored and processed in real-time by big and smart data methodologies (Botthof, 2014; Roth, 2016). Due to its many contacts and interfaces, procurement is the ideal function to adjust structures and processes to digitalisation and take over responsibility for Industry 4.0 implementations (Pellengahr et al., 2016).

Efficient processing of data evolving from digitalised processes is essential to make use of for market research, risk evaluation, supplier evaluation, demand analysis etc. to preserve competitiveness. Data serve as base for decision-making and have become a commodity themselves. (Kreutzer et al., 2017; Petry, 2016; Wallmüller, 2017; Weinreich, 2016)

The tasks of operational purchasing (purchase-to-pay P2P, order management) do not revolutionise, but they are rather automated and not carried out by PSM staff much longer. People working in procurement can focus more on strategic tasks. These are supported by digital solutions as well. (Petry, 2016; Wallmüller, 2017; Weinreich, 2016). Summarized it can be seen that PSM has to accomplish more strategic and interdisciplinary tasks with the help of modern technology (Schuh, Kromoser, Strohmer, Pérez and Triplat, 2011; Weigel and Rücker, 2015).

PSM organisation change due to the coordination of and intense collaboration with all internal and external partners (Bogaschewsky and Müller, 2008; Pellengahr et al., 2016; Weigel and Rücker, 2015). Buyers transform into interface managers, data analysts, innovation scouts and product developer. Besides explicit skills and knowledge in these new fields, soft skills such as communication with different stakeholders, persuasion, empathy, honesty, openness etc. are required to cope with the new roles.

The main statements of the PERFECT interviews regarding future skills and digitalisation aspects are briefly reproduced: The improvement of eProcurement solutions and implementation of new technical tools supporting standardisation and the automation of the P2P process is ongoing. Furthermore, operational as well as strategic tasks will be supported with robots and artificial intelligence more and more. Big data analytics are established to manage the flow of information, understand the market and support negotiation. IT skills are necessary to standardise systems, optimise and integrate processes for a better data exchange amongst the supply chain partners. Joint platforms are developed to support long-term strategic partnerships. Buyers and suppliers work closely with suppliers to foster innovation. People working in the PSM field need a holistic understanding of the business to understand the other function as their internal customers as well as external stakeholders. Leadership, problem solving, communication, analytical and strategic thinking, creative thinking and looking for new (digital) solutions belong to the broad set of capabilities. Interpersonal skills might become

more relevant because many other things have become automated. Still, different kinds of communication similar to social networks are increasing in the corporate world, as they can be faster and more efficient. Training is required for buyers as well as well-skilled students entering the workplace. Besides the digitalisation related skills and competences, PSM staff needs change management knowledge and competences in order to constantly being able to deal with transformation. (Project PERFECT, 2017)

The reasons for Change Management

The disruptive developments are triggers for the use of change management approaches. It reasonable to accompany the digital transformation in PSM with structured change management methods proactively. The implementation of tailored change management in PSM organisations makes sense in times of digitalisation. Feedback from customers and other stakeholders include the requirement for change management competences in PSM in order to enable the network to cope with the transformation. The environment changes fast and frequently, which needs action to remain competitive. For all aspects of digitalisation, employees need to be prepared and equipped in order to not be overstrained by its effects. For the companies' success, they should be enabled to react early to indications of possible future changes and influential developments. Digitalisation leads to growing education requirements and career opportunities. New and flexible profiles and ways of thinking will be needed in order to cope with these challenges. (Koch, Muschinski and Zeisel, 2017)

Changes in business context are often linked with anxiety of the staff about their personal employment situation. Transformation processes with their dimensions processes, leadership and qualification (Schwenker and Hanßen, 2009) as well as new forms of cooperation have to be structured systematically. In this context, use can be made of digitalisation for productivity and quality of work. To stay competitive, companies need to organise their environment with new technologies, adapt to changing organisation, processes and skill requirements and, therefore, include and qualify their purchasers at early stages.

There is explicit knowledge needed to deal with digitalisation, but certain competences and soft skills for the long-term orientation of digitised PSM are essential as well. This mixture of competences need to be included in trainings as part of a change management concept. Moreover, a transformation in a company can cause modifications in corporate objectives and values as an anticipation of and adaption to customer needs and transitioning environments is necessary (Kuntz and Gomes, 2012).

For a successful management of transformation, certain principles should be followed (Schwenker and Hanßen, 2009):

- Strategy based procedure
- Follow a holistic approach
- Strong governance of the transformation process
- Pragmatic application of differentiated and problem-based methods
- Broad Mobilisation of the organisation by change management.

The change management framework for digital transformation in PSM

In the following framework (see **Table 1**), the dimensions of transformation, the phases of change management, the aspects of digital transformation in PSM and skills requirement indications divided by strategic and operational PSM are listed in a matrix linking correlations. It gives a first overview maintaining general validity and without claim to comprehensiveness. Some transitions are fluent. It is a first draft of such a Change Management Framework for the Digital Transformation in PSM.

Change Management Framework for the Digital Transformation in Purchasing & Supply Management						
Transformation Principles (Schwenker and Hanßen, 2009) - Strategy based procedure - Follow a holistic approach - Strong governance of the transformation process - Pragmatic application of differentiated and problem-based methods - Broad Mobilisation of the organisation by change management.	**Business transformation dimensions** (Reineke and Bock, 2007)	**Change management phases**		**Challenges for PSM** (examples)		
		(Lewin, 1951)	(Kotter, 1995)	Supplier relationship: Scout and source innovation (examples)	From operational to strategic scope (examples)	...
	Reframing	Unfreeze	1 Establishing a sense of urgency 2 Forming a powerful guiding coalition 3 Creating a vision 4 Communicating the vision 5 Empowering others to act on the vision	- Status quo: analyse existing relations and innovation potential - Strengthen internal relations to clarify customer demand and product development processes - Market research for new innovative suppliers - Train staff in SRM, interpersonal communication, product knowledge - Establish long-term contracts with innovative suppliers, enlarge the network to n-tier suppliers and customers, share benefits - Constant market research updates	- Status quo: declining operational and growing strategic tasks - Clarify with staff a joint understanding of personal development opportunities - Develop a general vision on automated and strategic processes - Train the employees off and on the job (e.g. strategic thinking) - Highlight strategic improvements and benefits of the more strategic focus - Implement new tools and further trainings (e.g. big data analysis, integration of systems with stakeholders, communication)	...
	Restructuring	Move	6 Planning for and creating short-term wins			
	Revitalizing		7 Consolidating improvements and producing more change			
	Renewing		8 Institutionalizing new approaches			
		Refreeze				

Table 1: Draft of a Change Management Framework for the Digital Transformation in PSM (own illustration).

Conclusions and further research

This is a first draft of an integrated change management framework for the digital transformation in PSM. The characteristics of digitalisation of PSM will be worked out in more detail scientifically based and the models structure, applicability and completeness has to be tested in real life company cases. It is supposed to help companies and especially their PSM departments and related functions to restructure PSM organisation and processes and sustain change with the support of the staff.

Purchasing and Supply Management as an enterprise function has the opportunity to increase its importance by focussing on the newly upcoming tasks and paying attention to strategic approaches. Procurement can lead the way building up prospective competences to create understanding throughout the organisation and initiate innovative solutions coping with digitalisation when it accepts its pioneering role in the supply chains. (Pellengahr et al., 2016)

This research illustrates the first steps in developing a change management framework for PSM. Follow-up research can define learning, teaching and training methods for the identified competences in academia and practice and elaborate appropriate training courses as elements of a superior holistic change management concept.

The further goal is to develop a more detailed change management concept for PSM based on digitalisation impacts. Therefore, the analyses that are started for this working paper have to be conducted and evaluated in more detail. A structured complete literature review, more detailed analysis and comparisons, and a more detailed change management approach focusing on the dimension people and the challenges they face in their work environment, which digital skills and other skills related they need, how to train them and to enable them for the digital transformation are future research questions.

It needs to be investigated if and how it makes sense to apply change management methods selectively to one function like purchasing or if it needs to be embedded in the whole company, e.g. by breaking down a company-wide digital strategy to the functions. A number of levels of actions needs be defined as the sectors and digital transformation aspects to different degrees affect types of companies.

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European Higher Education Landscape – Analysis of existing purchasing study programmes

Laura Berger [a,*], Stephen Kelly [b,c], Klaas Stek [d,e], Bernd M. Zunk [e]

[a] TU Dortmund University, Leonhard-Euler-Str. 5, 44227 Dortmund, Germany

[b] Edge Hill University Business School, St Helens Road, Ormskirk, Lancashire, L39 4QP, United Kingdom

[c] Staffordshire University Business School, Brindley Building, Leek Road, Stoke-on-Trent, ST4 2DF, United Kingdom

[d] University of Twente, Drienerlolaan 5, 7522 NB Enschede, the Netherlands

[e] Graz University of Technology, Kopernikusgasse 24/II, 8010 Graz, Austria

[*] Corresponding author berger@lfo.tu-dortmund.de

Abstract

In the context of the development of an innovative Purchasing & Supply Management (PSM) curriculum, existing study programmes in different European countries are scanned and analysed in matters of learning goals, content and provided competences with the help of an academically deduced template. It is found that only very few PSM specific study programmes do exist in Europe. Moreover, distinct gaps between what these programmes offer and what is actually demanded by industry regarding conveyed skills are discovered. An objective of a newly designed curriculum is to fill the gap accordingly and serve the current needs.

Keywords: PSM Education, Study Programmes

Background and Introduction

The purchasing and supply management (PSM) function in any organisation is a key contributor to a firm's performance (Drake, 2012). A significant portion of the total turnover of a modern industrial firm in Europe is directly transferred to suppliers (Schmid and Grosche, 2008; Van Weele, 2010). Moreover, the bulk of supplies is often no longer of domestic origin, but of European and international nature. The discipline is nowadays characterized by strategic roles, rapid change and, increasing complexity and is highly effected by trends like ongoing globalisation, technological advances and new purchasing portfolios, which require adjusted skill sets. (Giunipero, Handfield and Eltantawy, 2006; Giunipero and Pearcy, 2000; Knight, Tu and Preston, 2014; Pellengahr, Schulte, Richard and Berg, 2016; Van Weele and Van Raaij, 2014)

Firms struggle to find effective and efficient ways to cope with these circumstances (The PERFECT Consortium, 2016; Van Weele and Van Raaij, 2014), even though these allow PSM to remain as, and even increase its role in being a key contributor to performance and strategic

leadership (Pellengahr et al., 2016). Employers have difficulties in attracting suitable candidates for vacant positions, particularly at the entry level (Hays plc, 2015). Reports show that companies have rarely taken further steps to create or feed their future talent pipeline sufficiently (DHL Supply Chain, 2017).

The project Purchasing Education and Research for European Competence Transfer (PERFECT) was set up in 2015 and is funded by the European Union under the Erasmus+ program "Strategic Partnerships for Higher Education" for the term 2015 to 2018. The overall objective of the project is to develop an empirically validated, innovative and harmonised Purchasing and Supply Management (PSM) curriculum (The PERFECT Consortium, 2016). The development of a pan-European curriculum for PSM education, which is based on a combination of identified best practices and industry requirements, will ensure that students are provided with the necessary knowledge and that they learn to join a purchasing department of any size of organisation ready to engage in different aspects and roles of purchasing. The most desired impact of the project is an increase in the number of highly qualified students who are suitable for entering the workplace in such PSM related jobs. (Berger, Straub and Henke, 2017; The PERFECT Consortium, 2016)

In order to do this, it is necessary to establish the context of the European Higher Education Landscape of the PSM field and, therefore, one important activity of the project is a scan and analysis of existing European PSM Higher Education curricula (The PERFECT Consortium, 2016). In parallel, the PERFECT project captured the current skills and competencies that PSM practitioners require now and in the future to deal with the demands of jobs in the field through an in-depth literature review. This procedure aims to identify relevant PSM courses and the topics they deal with on the one hand. On the other hand, these findings are compared with the relevant skills and competencies to be provided in order to discover the gaps about which of the later are not adequately represented in the current education provision (cf. Birou, Lutz and Zsidisin, 2016).

The initial PSM Skills Model of project PERFECT (based on Schiele, 2007) with the top 10 skills identified as listed in **Table 1** is based on input from the literature review, job advertisements, practitioner skills models and studies on trends and future skills.

Negotiation skills	Cost analysis
Analytical skills	Leadership
Problem solving	Change management
Risk management	Supplier relationship management
Decision making	Strategic thinking

Table 1: Top 10 skills identified (The PERFECT Consortium, 2016).

The central problem is the mismatch between skills taught and skills needed in European PSM programmes. This paper highlights the methods and findings of the analyses of programmes in different European countries.

The scope lies on explicit purchasing and supply management (PSM) studies. PSM is understood as comprising the management of external inputs (materials, services, capabilities and

knowledge) that are required for building, running and maintaining the focal firm's processes, while simultaneously managing the external and internal stakeholder network with an extended upstream supply network understanding (The PERFECT Consortium, 2016), as visualised in **Figure 1**.

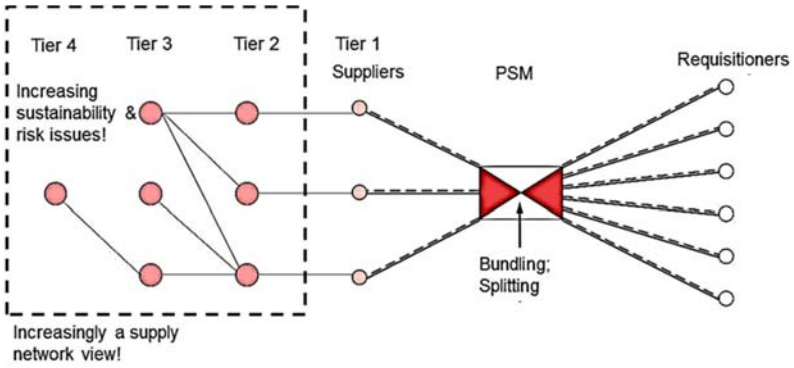

Figure 1: Purchasing & Supply Management scope (The PERFECT Consortium, 2016). Adapted from (Kummer et al., 2013).

Methodology for the Analysis of Existing Purchasing Study Programmes in Europe

The review process requires the identification and afterwards the analysis of relevant PSM courses/study programmes.

The education landscape is identified by Google searches and searches via specific course search engines listing existing study programmes in the respective countries. The search includes undergraduate/Bachelor and postgraduate/Master courses at universities and universities of applied sciences in the field of purchasing and supply management. Courses that are more general entitled with supply chain management, business or logistics programmes including purchasing modules are not considered due to the high amount and difficulty of ensuring completeness.

The analysis embraces courses from a variety of European countries with different level of detail. Following countries are included in this research: Germany, the Netherlands, United Kingdom, Finland, Switzerland and Austria plus a few single programmes from Denmark, France, Ireland and Italy. In the Netherlands, the research focus lies on single modules or courses as no full purchasing study programmes were found. No purchasing degrees were found in Austria neither. The detected variety of focused PSM courses is listed in **Table 2**. The final database includes 19 PSM study programmes (7 UG, 12 G) and 22 single courses in the Netherlands taught at 12 different universities and 13 universities of applied sciences.

Country	Institution	Programme
Germany	Technische Hochschule Ingolstadt (Master, extra-occupational)	Strategisches Beschaffungsmanagement (Strategic Purchasing Management)
Germany	BME–Akademie GmbH (Master, extra-occupational)	Strategisches Beschaffungsmanagement (Strategic Purchasing Management)
Germany	EURO-FH (Bachelor)	Einkauf und Logistikmanagement (Purchasing and Logistics Management)

Germany	Hochschule Heilbronn (Bachelor)	Management & Beschaffungswirtschaft (Management and Procurement)
Germany	OHM Professional School der TH Nürnberg in Kooperation mit der Hochschule Hof (Master, extra-occupational)	Einkauf und Logistik/SCM (Purchasing and Logistics/SCM)
Germany	Universität Würzburg (Master, extra-occupational)	Executive MBA mit dem Schwerpunkt (focus on) Purchasing & Supply Chain Management
Germany	AFUM Akademie für Unternehmensmanagement (Master)	Procurement Management
Germany	FHDW Bielefeld (Master, extra-occupational)	Einkauf und Logistikmanagement (Purchasing and Logistics Management)
Germany	FH Kiel (Bachelor)	Internationales Vertriebs- und Einkaufsingenieurwesen -Bachelor of Engineering (International Sales and Purchasing Engineering)
Germany	Hochschule Aschaffenburg (Bachelor)	Einkaufs- und Qualitätsmanagement (Purchasing and Quality Management)
Netherlands	University of Twente Technical University Eindhoven Maastricht University Erasmus University Rotterdam Tilburg University University of Groningen TIAS School for Business and Society	22 single courses with 5-15 ECTS from Bachelor and Master programmes
UK	CIPS	Chartered Institute of Procurement & Supply Levels 4, 5 and 6
UK	Aston University (Bachelor)	BSc Logistics with Purchasing Management
UK	Greenwich University (Bachelor)	Business Purchasing and Supply Chain Management
Finland	Aalto University	Diploma in Global Supply Management (DGS)
Austria	-	-
Switzerland	Fachhochschule Nordwestschweiz (Master)	Supply Management Excellence
Denmark	Copenhagen Business School (Master)	Minor in Strategic Procurement
Ireland	Irish Institute of Purchasing & Materials Management (Bachelor)	Procurement and Supply Management
Italy	Politecnico di Milano Graduate School of Business (Master)	Supply Chain and Purchasing Management
France	SKEMA Business School (Master)	Supply Chain Management & Purchasing

Table 2: analysed PSM higher education programmes

This descriptive analysis includes gathering information on the programme, name, level, duration, course contents and goals, education methods, evaluation criteria, and amount of ECTS, if detectable. Information from websites like course overviews and descriptions, module handbooks, and in some cases additional personal contact provided information about the content of the study programmes, courses and modules to be analysed in detail.

Having established what the current PSM education landscape looks like, a gap analysis between the Skills Maturity Model and the educational landscape is undertaken. Mentioned PSM Skills Model was developed during the initial work stages in project PERFECT (The PERFECT Consortium, 2016). It is based on the PSM Maturity Model by Schiele (Schiele, 2007), which became complemented with results of literature review, job advertisements and latest studies. It reflects the status of relevant PSM competences derived from mentioned various sources.

An excerpt of the skills model is displayed in **Table 3**. Each line has several sub-categories, which reflect the wide range of explicit and tacit PSM skills in more detail.

	Management Function	*Description*	*Percentages*	*EC observed*	*Observations*
Total			0,0	0,00	
PL	**Planning and Strategy**		0,0	0,00	
PL1	**Demand Planning**		0,0	0,00	
PL2	**Pooling Planning**		0,0	0,00	
PL3	**Market Analysis and Planning**		0,0	0,00	
PL4	**Innovation Analysis and Planning**		0,0	0,00	
PL5	**Sourcing Strategy Planning**		0,0	0,00	
SO	**Structural Organisation**		0,0	0,00	
SO1	**Organisational Structure and Mandates**		0,0	0,00	
SO2	**Strategic Integration with Board**		0,0	0,00	
SO3	**Purchasing Involvement with other Functions**		0,0	0,00	
PO	**Process Organisation**		0,0	0,00	
PO1	**Supplier Selection**		0,0	0,00	
PO2	**Negotiation**		0,0	0,00	
PO3	**Contract Development and Management**		0,0	0,00	
PO4	**Supplier Risk Management**		0,0	0,00	
PO5	**Supplier Evalution**		0,0	0,00	
PO6	**Supplier Development**		0,0	0,00	
PO7	**Early Supplier Involvement**		0,0	0,00	
HR	**Human Resources and Leadership**		0,0	0,00	
HR1	**Job Descriptions and Competences**		0,0	0,00	
HR2	**Personnel Selection and Integration**		0,0	0,00	
HR3	**Performance Appraisal and Career Development**		0,0	0,00	
HR4	**Soft Skills Development (Explicit Training)**		0,0	0,00	
HR5	**Soft Skills Development (No EC, Indirectly Acquired)**				
CO	**Controlling**		0,0	0,00	
CO1	**Controlling Target System**		0,0	0,00	
CO2	**Purchasing Controlling Process and Structure**		0,0	0,00	
CO3	**Methods and Tools Support**		0,0	0,00	
CO4	**Supportive IT**		0,0	0,00	
OT	**Other**		0,0	0,00	
OT1	**Other (purchasing)**		0,0	0,00	
OT1	**Other (non purchasing)**		0,0	0,00	

Table 3: Purchasing Education Content Mapping Model (without showing sub-categories)

The comparison and detection of gaps is conducted by allocating a percentage value of the content that is taught against the skill areas of the model. This is done for all single modules and courses forming a study programme. The number of ECTS for each course topic is considered. In addition, skills students may develop tacitly for instance from means such as participating in group debates or presentations were included to establish the full skill set that education providers are offering in their curriculum.

Sums are calculated to gain overviews of the distribution of taught skills in complete study programmes and in the European whole education landscape that is investigated.

Results

This analysis provides an initial indication of gaps between PSM skills required and what the PSM landscape is currently providing (Project PERFECT, 2018; The PERFECT Consortium, 2016).

The curriculum documents and available information of the analysed study programmes vary significantly. Furthermore, the standards of teaching vary widely, as PSM teaching does not have a harmonised tradition like other disciplines do. Still some generally admitted results are derived from the analysed material.

In summary, the PSM education landscape is characterised by the following:

- Short courses, only few full study programmes.
- Emphasis on post-graduate courses and some professional courses targeting individuals already working in the PSM field.
- Only few university and other higher education institutions offer PSM tracks.
- Most full programmes offered by universities of applied sciences.
- There is no harmonisation; each institution has its own focus.

A detailed analysis of course content using the method detailed above identified a number of key gaps, as well as strengths. The data shows that the PSM Education content analysed has a clear focus on the more processual aspects of PSM (Planning and Strategy), but is partly lacking in Structural Organisation, interdisciplinary understanding and particularly in Human Resources & Leadership aspects. Also the areas of sustainability and digitisation, which were confirmed as main future influence areas for procurement (Project PERFECT, 2017b), are underrepresented in existing curricula. Furthermore, the relevant aspects technology scouting, innovation sourcing, compliance and sustainability, change and human resource management (e.g. Pellengahr et al., 2016) are not sufficiently covered in existing programs.

Only few programmes are future-oriented and close to praxis. They contain business basics, but lack engineering and IT knowledge as well as active participation in the courses. Current studies show that in the future a broader scope of necessary skills then currently offered in higher education is required (e.g. DHL Supply Chain, 2017).

Compared with the findings of the PSM maturity based skill model top 10 skills identified (table 1), the mapped courses show that least attention is paid to soft skills development, either direct or indirect. The most explicitly taught soft skill is communication skills, being part of the top 10 in the PSM Maturity based skill model as well. In the future, greater focussing on identified skills, which include many soft/tacit/non-technical ones than covered in existing courses is needed.

The results go in line with Birou et al., 2016, who analysed PSM courses in the USA. This paper extends their research by the European dimension. The analysis shows that the relevant

aspects of PSM and the required competences are not fully reflected in academic education. A couple of universities offer single PSM courses, but the imbalance between consecutive and executive programs points out the mismatch between offer and demand of PSM education. The European PSM education landscape is characterised by a number of short, post-graduate or tailored professional courses. PSM is mostly only part of generic study programs such as Business or Supply Chain Management. This makes it necessary for companies to hire university graduates with other specializations and often spend years bringing them up to a skill level, which graduates in other disciplines already possess. (The PERFECT Consortium, 2016)

One of the key aims of the PSM profession undertaken over the last 20 years is to assert the importance of PSM within the organisational context and this analysis suggests that the current educational provision is not adequately preparing graduating students with the skills they need to further these goals and become more entrepreneurial business leaders. Whilst not underestimating the importance and necessity of technical PSM skills, the development of a pan-European PSM curriculum, as well as a skills assessment tool and a massive open online course (MOOC) on PSM fundamentals until summer 2018 in the framework of the project PERFECT needs to ensure that this broader skill set is adequately represented. There is a need for a PSM focused curriculum that will allow organisations to recruit graduate employees who are ready and prepared to cope with current and future requirements of PSM. Basic factors for the success of the project to ensure the novelty of the curriculum are the requirements that the curriculum (Project PERFECT, 2018):

- Meets the varied needs of different industrial sectors and organisations.
- Ensures that the PSM graduates are as prepared as possible for a variety of PSM roles.
- Can be flexibly used by a variety of Higher Education Institutions across Europe and form the basis of their own internal validation or accreditation requirements.
- Can be used by organisations as the basis of their own internal training programmes.
- Recognises the future requirements of the PSM field.
- Contributes to the enhanced perception of the PSM profession.
- Is based on contemporary approaches to and principles of teaching and learning and harnesses technological developments.
- Puts the student at the heart of the curriculum.

To close the gaps, a PSM curriculum consisting of different modules (listed in **Table 4**) is designed in the core work package of the project PERFECT. It describes the roadmap in developing an innovative and harmonised curriculum. The modular structure allows the adaption of either the whole programme for start-up PSM chairs or the selective choice of certain modules in order to fill up and strengthen existing programmes with PSM aspects. (Project PERFECT, 2018)

Category Management	Personal skills/Personal Development skills
Commercial Law	PSM Technology in a Digital Environment
Commercial Negotiation	Purchasing Finance
Cross-functional working	Purchasing Fundamentals
Customer Service	Quality Management in PSM
Entrepreneurial PSM	Risk Management in PSM

International Context of PSM	Advanced Category Management
Management & Leadership in a PSM context	Supply Chain Management
Operations Management	Sustainability Management
Organisational change	The Business Context
People skills/Interpersonal skills	Optional Language Modules as appropriate

Table 4: Modules of the new PSM curriculum

Conclusion, limitations and future research

This research misses a clear innovative contribution to academic PSM research as it is derived from an education project. Nevertheless, it gives an indication of the significance of PSM study programmes and hints on the development of new ones. This work contributes to the field of PSM education by identifying gaps in the contemporary education landscape that are seen as important for current and future PSM practice. The development of a harmonised and empirically validated European curriculum for the PSM discipline offers a significant opportunity to improve the described circumstances by closing the gap between new industry requirements caused by changes like digitalisation and existing study programs. Therefore, the results justify the endeavour of the EU project PERFECT to develop a new PSM curriculum.

Hardly any soft skills are taught in the analysed courses while this is considered as important by academic literature and studies focusing on trends in PSM. The current focus in PSM education lies on teaching explicit knowledge with traditional methods (via e.g. books, frontal lectures) instead of putting across tacit knowledge and competences. Institutions should facilitate their students in learning about necessary soft skills theoretically and about the application with direct and implicit teaching through interactive and practice oriented teaching and learning methods like for example, guest lectures, case studies, company projects, role-plays, teamwork, reflection sessions or mentoring. The Standards and guidelines for quality assurance in the European Higher Education Area (ESG) refer to such student-centred learning. They oblige institutes of higher education to encourage students to take an active role in creating the learning process (Standards and Guidelines for Quality Assurance in the European Higher Education Area, 2015). In context with the literature student-centred learning is the future teaching method that is preferable for teaching PSM at institutes for higher education. This would incorporate the need of teaching knowledge and soft-skills in order to fill the existing gap between the needs in practice and existing study programs in higher education.

A change is indispensable to meet employers' demands as well as to keep up the role and meaning of purchasing in the business context and even make use of the change of strategic enhancements of the function.

Apparently, the number of analysed countries is not representative for all European countries and does not include all cultural clusters (Hofstede, 1984; Kale, 1995); this may have created some bias. The necessity of further analysis, e.g. on additional countries and additional detailed comparison and adjustment with industry requirements undeniable. In further research, a widespread scan of all European PSM study programmes should be aspired. In addition, the skills,

which make a PSM professional successful, can slightly differ in different countries, as indicated by the results of a survey conducted in the project context (Project PERFECT, 2017a). As already discovered in previous research, there are gaps in PSM strategic influence factors such as purchasing skills, knowledge, professionalism, and status depending on focused companies; the sizes of discovered gaps differ, but the reasons are similar (Ogden, Rossetti and Hendrick, 2007). It is a reasonable attempt to solve this by a harmonised curriculum.

Furthermore, this study focuses on fully PSM centred study programmes only. Purchasing topics are often parts of other disciplines' courses such as supply chain management, logistics, and business in general (The PERFECT Consortium, 2016). A very in depth analyses of a huge number of courses would be necessary to discover all of these. Besides, it was only possible to look at snap-shots of current curricula; dynamics and past developments of the courses are not considered.

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What do suppliers perceive? The emergence of external social capital under conditions of environmental uncertainty

Tobias Bohnenkamp, Holger Schiele and Matthias De Visser
University of Twente, The Netherlands

Abstract

Given a fundamental change in supply chain organization buying firms increasingly have to deal with a smaller number of key suppliers that employ extended value adding responsibilities. Buying firms thus have to pay attention to establish relationships with these suppliers in order to prevent the risk of resource scarcity. While social capital theory has been considered for testing relationships, the effect of internal social capital on the emergence of external social capital is understudied. This especially holds when focusing on the perception that suppliers have about their customer organization's internal relations. Since already this perception could define whether a relationship is meant to last or not, gaining an understanding of this situation can be crucial for relationship management. Therefore, our study tests the effect of perceived internal social capital on the emergence of external social capital. Further, the influence of environmental conditions, including complexity, dynamism and munificence is considered. With this, our study contributes to the further development of social capital theory.

Keywords: Social capital, environmental complexity, environmental dynamism, environmental munificence

1. INTRODUCTION

Over the last decades, the value of inter-organizational relationship has gained increased recognition, being considered a fruitful source for achieving sustainable competitive advantages (Krause et al., 2007). Nowadays being able to bind parties together becomes especially crucial: On the one hand a fundamental change in supply chain organization has resulted in increasing responsibilities for suppliers (Schiele et al., 2015), on the other hand supply bases are more often consolidated in order to include a smaller number of key suppliers (Eggert and Ulaga, 2010). Consequently, since suppliers have constraints on resources they can devote to other parties (Schiele et al., 2015), having close, social relationships with them becomes top priority for buying firms. From the theoretical perspective, social capital theory has been considered for studying relationships between individuals and organizations (Ahuja, 2000; Tsai and Ghoshal, 1998). Building external relationships between buyer and supplier, however, only works if smooth running internal cross-functional relationships are in place (Zhao et al., 2011). As shown by Horn et al. (2014), the presence of internal social capital can be considered a prerequisite for

the emergence of external social capital. Though, while the authors surveyed a sample of purchasing managers, the supplier perspective was omitted. Interestingly, research on how suppliers perceive internal social capital present cross-functionally within the buying organization and, in turn, how this perception influences the emergence and development of external social capital within the relationship between the supplier and this specific buyer are, a priori, neglected in literature. Since suppliers never only deal with the purchasing function per se but are also in contact with other functions, such as Quality or R&D, we assume that suppliers are able to notice whether or not internal social capital exists. Arguably of course, this is only possible for suppliers that already had the first encounters with the buying firm. The neglect in literature on the relationship between perception and result, though, is unfortunate given that this understanding could improve future cooperation between buyer and supplier. As such, the interplay between perceived internal social capital and the development of external social capital could further enhance supply management as well as B2B marketing literature. Intending to close this gap, our study, through the pursuit of a quantitative approach, will aim to answer the following research question:

To what extent does perceived internal social capital influence building external social capital?

Social capital and, on a broader level, buyer-supplier relationships, however, are not to be seen as a self-contained system, but have to be considered in a wider context (Gelderman et al., 2016). An overarching factor that is understood to influence every buyer-supplier relationship to some degree is the environment or market that firms are operating in (Paulraj and Chen, 2007). Given the environmental pressure, firms have to rely on inter-organizational relationships to a smaller or greater extent (Matanda and Freeman, 2009). Commonly, academics distinguish between (1) environmental complexity (Starbuck, 1976; Bozarth et al., 2009), (2) environmental dynamism (Dess and Beard, 1984; Aldrich and Pfeffer, 1976) and (3) environmental munificence (Dess and Beard, 1984; Starbuck, 1976). What is missing, however, is the effect that the three attributes have on the development of social capital. Since the uncertainty of an environment firms are operating in can cause difficulties for achieving goals, thus requiring them to seek for closer relationships (Cousins and Spekman, 2003), it is fair to assume that this might also moderate the interplay of perception and result. In order to better understand this construct, the following research question is postulated:

To what extent do environmental complexity, environmental dynamism and environmental munificence influence building social capital?

By answering the two research questions, our paper will contribute in two directions:
(1) Firstly, our study will further extend the cohesive research on social capital in buyer-supplier relationships, specifically paying attention to the supplier point of view, and thus answering calls for more supplier-centric research (Carey et al., 2011). By considering the influence of perceptions suppliers have of their buyers internal relationships on the quality of their external relations between both parties, our study will provide indications to forming and sustaining inter-organizational relationships.
(2) In addition, our study will test for the effect the environment firms are operating in, including its complexity, dynamism and munificence, has on the development of social capital in inter-organization relationships. To our knowledge, research on social capital theory has not yet examined these possible influencing factors.

The paper will be organized as follows: Through conducting an extensive literature review, all variables will be introduced. Subsequently, the focus will lie on the research methodology, followed by a presentation of findings and limitations .

2. THEORETICAL CONSIDERATIONS

2.1 Social capital theory: Cognitive, structural and relational capital define the concept.

Social capital, being grounded on social relations, is understood as goodwill that is available to individuals as well as groups (Adler and Kwon, 2002). It can be referred to as resources, of actual or potential nature, that are available to different actors within a relationship and that comprises contextual factors underlying the resource exchange (Kankanhalli et al., 2005; Nahapiet and Ghoshal, 1998). As such, social capital considers social ties that are difficult to imitate and potentially able to generate a competitive advantage (Edelman et al., 2004). In academics the notion of social capital has been used as theoretical lens for studying relationships between individuals and organizations (Ahuja, 2000; Tsai and Ghoshal, 1998), or at more recent state in the field of supply management focusing on buyer and supplier interactions (Hartmann and Herb, 2014; Horn et al., 2014). Nahapiet and Ghoshal (1998) further divide social capital into three separate dimensions, distinguishing between (1) cognitive capital, (2) structural capital and (3) relational capital. While the majority of studies examine these dimensions as in parallel existing constructs, others also consider cognitive and structural capital as antecedents of relational capital (Carey et al., 2011; Horn et al., 2014; Preston et al., 2016).

Common values and visions shared by actors within a relationship are underlying the cognitive dimension (Tsai and Ghoshal, 1998). They also include common goals, norms and beliefs contributing to the understanding of the social system, as well as shared interpretations, such as language or signs (Uphoff and Wijayaratna, 2000; Tsai et al., 2008). A high level of cognitive capital therefore implicates that these attributes are shared by both relationship partners to a high extent. In this way, cognitive capital enables a consensus on strategic goals and processes that both parties might benefit from (Atuahene-Gima and Murray, 2007; Adler and Kwon, 2002).

Structural social capital refers to pattern of connections between parties as well as how they can be used and how frequent they occur (Burt, 1997; Villena et al., 2011). A high level of structural capital can therefore be found if both actors within a relation utilize multiple channel of interaction to facilitate the information and resource exchange (Koka and Prescott, 2002; Villena et al., 2011). The common usage of resources is enhanced through clarity, transparency on actions and processes fostered by a strong and consistent flow of information. This is stressed by empirical findings reporting the positive effect of structural capital on “information flow” and “information diversity” (Koka and Prescott, 2002).

Finally, the relational dimension of social capital, being based on the notion of Granovetter and Swedberg (1992) refers to embeddedness and to the relationships that actors have developed. It is considered closely connected to cognitive and structural capital, and further expressed through trust, friendship as well as mutual respect that partners have for each other (Kale et al., 2000) (Kale et al., 2000). Arguably, if parties in a relationship share common business goals and ideas as well as holding a dense net of interactions, relational capital might be more likely to develop (Tsai & Ghoshal, 1998). In the same way, a relationship based on trust requires frequent interaction and the means to do so. Interestingly, if trust and commitment are present, the information flow and intensity are increased (Hartmann and Herb, 2014).

The majority of studies focusing on social capital have been conducted from the buyer point of view, omitting the supplier perspective. Gaining understanding on not only the buyer but also the supplier side is however crucial for relationship management. Also, influencing external factors, such as the firm environment, that might affect the emergence and development of social capital within a relationship have not been discussed to a larger extent, being introduced subsequently.

2.2 The environmental context: Complexity, dynamism and munificence influence firm behavior.

Several studies have already shown that the environments firms are operating in can affect their choice of strategy as well as their performance (McArthur and Nystrom, 1991; Clark, 1971). The most commonly addressed attributes of the environment include (1) complexity, (2) dynamism and (3) munificence (Bozarth et al., 2009; Dess and Beard, 1984; Starbuck, 1976; McArthur and Nystrom, 1991). According to this consensus, these three factors are most important and allow characterizing the firm environment in the best possible way.

Compexity has been defined as the number and interconnectedness of elements in a system (Bourgeois, 1980; Bozarth et al., 2009). Environmental complexity refers to the heterogeneity a market displays as well as the dispersion of activities that organizations operating inside conduct (Starbuck, 1976; Choi and Krause, 2006). While simple environments are known for their homogeneity with few interactions between parties, complex environments depict a high degree of heterogeneous elements, requiring numerous interactions (Choi and Krause, 2006).

Dynamism on the other hand includes the change of elements and relationships over time (Aldrich, 1979, Bourgeois, 1980). As such, it also refers to the degree of predictability that these elements are changing (Dess and Beard, 1984). Environmental dynamism focuses on the degree to which a market is stable (or not) and to which extent the interconnectedness between firms cause turbulence (Mintzberg, 1979). While stable and slowly changing environments depict a low degree of dynamism, instability and fast changing circumstances are the main characteristic of highly dynamic environments (Calantone et al., 2003).

Finally, munificence focuses on the availability (or abundance) of resources that firms can nourish from. Environmental munificence therefore describes the capacity and opportunities firms have in a market as well as the extent to which it can support sustained growth (Randolph and Dess, 1984; Starbuck, 1976; Dess and Beard, 1984). As such, environmental munificence is also always related to the number of firms operating in the market, competing for these resources (Ward et al., 1995; Mintzberg, 1979).

After having introduced the theoretical constructs that our paper is based on, the next section will derive hypotheses that are to be tested.

2.3 Hypotheses

The study at hand considers by suppliers' perceived internal social capital present at their customer organizations as well as external social capital developing between suppliers and their customer as a result from this.

Firms that incorporate a high level of internal social capital are likely to foster a highly collaborative organizational environment (Leana and Pil, 2006; Sparrowe et al., 2001; Madhavaram and Hunt, 2017). They can be understood to practice extensive cooperation as well as communication on a functional level (Rosenzweig et al., 2003; Sherman et al., 2000). As such, employees from different functions work together in teams, exchange ideas regularly and provide their insights based on their diverse backgrounds. Utilizing a collaborative environment like this,

buyer and supplier have the nourishing basis to build up or develop external social capital together (Narasimhan and Kim, 2001). Through common meetings with different functions of his customer, the supplier could perceive this collaborative environment, the accumulation of internal social capital and acknowledge it as stimulating.
Employing the view of cognitive capital, internal cognitive capital would imply that departments, as well as employees working within these departments, share the same values and have a common understanding of what the goals of the their company are and how they can contribute together in the best possible way to achieve them (Tsai and Ghoshal, 1998; Uphoff and Wijayaratna, 2000). This unification in terms of goal alignment and values, departments would also exhibit to the outside world. As such, they are able to encourage the communication of these shared goals and values to other organizations (Thompson and Fine, 1999). Thus, for suppliers perceiving internal cognitive capital from their customers it would be less difficult to understand what the customer is aiming for and find common grounds to align their goals, since departments of the customer speak the same "language". Consequently, the suppliers would consider it valuable to develop external cognitive capital with their customer in order to reach their own goals more effectively. Following this, H1.1 has been formulated.

H1.1 The perception of internal cognitive capital is positively related to the development of external cognitive capital.

In terms of structural capital, internal structural capital would imply that departments within the organization would utilize multiple channels of interacting with each other (Nahapiet and Ghoshal, 1998; Villena et al., 2011). In other words, a high level of internal structural capital would entail intra-organizational communication through a variety of means, including not only the exchange of information via emails but also by personal and direct interaction in cross-functional meetings. Also, the frequencies of how the departments communicate as well as the hierarchical levels they use define internal structural capital (Burt, 1997; Villena et al., 2011). For suppliers it could be relatively easy to perceive whether internal structural capital is present at their customer's organization or not: Through visiting their customer or through having common project meetings, the suppliers could easily assess whether the information they receive from various parties is accurate and reliable (Chen et al., 2009; Villena et al., 2011) as well as, most importantly, aligned. Since information reliability provides the suppliers with planning security and prevents problems, the suppliers can be expected to develop external structural capital with their customer in order to access the customer's internal network and gain knowledge through it. Accordingly, H1.2 was formulated.

H1.2 The perception of internal structural capital is positively related to the development of external structural capital.

Finally, internal relational capital refers to trust and commitment that departments have for and share with each other (Lee and Cavusgil, 2006). A high degree of internal relational capital thus implies that departments trust each other to follow up on promises made and commit themselves to a common purpose for their firm. On the other hand, internal relational capital also prevents opportunistic behavior among departments and their employees (Kale et al., 2000; Villena et al., 2011) through leaking or withholding relevant information in order to e.g. decrease other parties' reputation and vice versa increase their own chances of promotion. Literature also argues that (internal) cognitive and structural capital are both positively related to the accumulation of

relational capital (Tsai and Ghoshal, 1998; Carey et al., 2011; Horn et al., 2014).
From the supplier point of view, the trust and commitment present within their customer's organization can be perceived from meetings with this customer, through the way departments dealing with the supplier interact with each other, how transparent they communicate as well as how aligned and familiar with each other they appear. The presence of internal relational capital could urge the supplier to also feel more secure about the information that is received as well as dedicated towards the common goal and project outcome. Having less to worry about being taken advantage of (Tsai and Ghoshal, 1998), the supplier could more openly share his resources and commonly improve both organizations performance (Lawson et al., 2008; Gelderman, 2016). Consequently, external relational capital would develop, being reflected in H1.3.

H1.3 The perception of internal relational capital is positively related to the development of external relational capital.

Next to the presumed relationship between perceived internal social capital and the development of external social capital, we also expect moderating factors to affect respectively stimulate this relationship. The moderating factor that we are paying attention to in this study is the firm environment. With literature having established how the firm environment can influence their strategic decisions (McArthur and Nymeth, 1991; Clark, 1971), firms are required to take precautionary actions for their own good. Through employing a strategic supply management role, firms can attempt to control environmental influences (Pfeffer and Nowak, 1976) and seek for predictably and stability (Bresser and Harl, 1986).
Operating in complex environments, firms are dealing with a high extent of competition, multiple ties and interconnections between firms as well as a lack of transparency preventing a full understanding of the market (Bozarth et al., 2009; Choi and Krause, 2006). Under these conditions of complexity, firms are well advised to seek for close relationships, relationships that guarantee them long term planning and orientation (Shin et al., 2000; Cousins and Spekman, 2003) in order to minimize and share potentials risks (Kotabe et al., 2003). As such, being the basis of every relationship (Ahuja, 2000; Tsai and Ghoshal, 1998) social capital could well be linked to environmental complexity.
In terms of cognitive capital under environmental complexity, suppliers perceiving internal cognitive capital from their customer would have a strong urge to bind with the customer and develop external cognitive capital: Since clarity on goals and targets as well as on values and work ethics prevents conflicts through developing a clear common understanding and allows for more effective planning (Terawatanavong et al., 2011), a must to survive in a complex environment, the supplier would consider a long-term relationship with their customer highly valuable. Further, in order to secure a long-lasting relationship with the customer, the supplier would try to align his goals with the goals of his business partner in order to prevent a contradiction on objectives. As such, the supplier would be led to develop external cognitive capital even stronger than without environmental complexity, resulting in H2.1.

H2.1 The presence of environmental complexity positively moderates the relationship between perceived internal cognitive capital and the development of external cognitive capital.

Through developing structural social capital with their customer, suppliers would be able to increase their external information flow (Koka and Prescott, 2002; Villena et al., 2011), and gain a clearer understanding about the market and thus about available resources and movements of

other firms as well as their business relationships and interactions. With this they would meet their information requirement and are able to commonly develop strategies for dealing with the environmental circumstances (Choi and Krause, 2006; Aldrich, 1979; Dess and Beard, 1984). Following this logic, suppliers perceiving the presence of internal structural capital are aware that their customer has the right structures and effective communication means to analyze their complex environment and deal with it accurately. As such, the supplier would be eager to also profit from these structures and further develop external structural capital, leading to H2.2.

H2.2 The presence of environmental complexity positively moderates the relationship between perceived internal structural capital and the development of external structural capital.

Finally, every relationship that wants to endure requires trust, commitment and reciprocity (Blonska et al., 2013). This is especially the case in environments which, by means of its complex nature, make ties and partnerships in order to sustain necessary. In this sense, relationships can well be considered resources (Lavie, 2006; Dyer and Singh, 1998) that support firms operating in complex environments (Choi and Krause, 2006; Aldrich, 1979; Dess and Beard, 1984). As has been pointed out, relational capital ensures that firms can trust and rely on the information they receive (Kale et al., 2000; Villena et al., 2011), an indispensable condition under environmental complexity. As such, suppliers perceiving internal relational capital from their customer might also be more likely to rely on the information they receive from this customer. Having obtained accurate information, the suppliers are more able to deal with their market in an attempt to reduce complexity. Consequently, the supplier would then also develop external relational capital with their customer in order to become part of a long-term oriented relationship (Cousins and Spekman, 2003; Shin, Collier and Wilson, 2000). Thus it is fair to postulate H2.3.

H2.3 The presence of environmental complexity positively moderates the relationship between perceived internal relational capital and the development of external relational capital.

Next to environmental complexity, the dynamics an environment underlies is a major influencing factor for firms (Aldrich, 1979, Bourgeois, 1980). In dynamic environments, characterized by low instability and fast change (Calatone et al., 2003), firms are more likely to engage in collective action and build closer relationships for stabilizing their environment (Salancik and Pfeffer, 1978; Zenger and Hesterly, 1997). As such having strong and in-depth relationships leads to increased coordination between firms counteracting the unpredictable nature of a dynamic environment (Paulraj and Chen, 2007). In this sense, the development of social capital can also be linked to environmental complexity.
In terms of cognitive capital, being internally aligned on goals, targets and values can be a means to create stability from the within in an otherwise unstable environment, through possessing a common understanding between internal parties (Tsai and Ghoshal, 1998; Uphoff and Wijayaratna, 2000). As such, when it comes to building relationships for stabilizing the market, the internal organizational environment could well be a point of departure (Narasimhan and Kim, 2001). Suppliers operating in a dynamic environment perceiving the presence of internal cognitive capital from their customer would obtain the picture that this customer is internally well established with functions being on the same line in an attempt to deal with external unpredictability (Dess and Beard, 1984). Similar to environmental complexity, the supplier would try to align and match his own goals with the goals of the customer to make a long-term relationship possible, thus attempting to develop external cognitive capital (H3.1).

H3.1 The presence of environmental dynamism positively moderates the relationship between perceived internal cognitive capital and the development of external cognitive capital.

As has been described in literature, collective actions between parties are a way to deal with dynamic and unstable environments (Pfeffer and Salancik, 1978; Zenger and Hesterly, 1997). Deploying structural social capital, developing strong communication mechanisms at high frequencies (Villena et al., 2011), is therefore a means to stabilize the environment. Suppliers that perceive that internal structures exist at their buying firm that allow for constant alignment and information exchange (Nahapiet and Ghoshal, 1998; Villena et al., 2011) might consider to also utilize and profit from this internal network in order to deal with the unpredictable environment they are operating in. As such, through developing external structural capital with the customer, supplier and customer could align their communication structures and insure themselves more carefully against changes in their environment. Following this, H3.2 was formulated.

H3.2 The presence of environmental dynamism positively moderates the relationship between perceived internal structural capital and the development of external structural capital.

Also, relational capital plays a role when it comes to stabilizing dynamic environments being closely connected to structural and cognitive capital (Carey et al. 2011), creating trust and commitment between relationship partners and preventing opportunistic behavior (Villena et al, 2011; Kale et al., 2000). All those attributes can be understood as requirements when executing collective actions by firms that have been said to positively affect the predictability of dynamic environments (Pfeffer and Salancik, 1978; Zenger and Hesterly, 1997). Similar to under environmentally complex conditions, suppliers that perceive the presence of relational capital at their customer know that departments are committed to their common purpose and do not engage in opportunistic actions (Villena et al., 2011). With this, also the reliability of information flowing through departments cross-functionally is ensured. Consequently, suppliers can be more certain that this customer is more suitable for collectively operating in and stabilizing their dynamic environment. As such, they also commit to developing an in-depth relationship and accumulate external relational capital with this customer, leading to hypothesis H3.3.

H3.3 The presence of environmental dynamism positively moderates the relationship between perceived internal relational capital and the development of external relational capital.

Finally, the last attribute characterizing the environment firms are operating in is environmental munificence (Starbuck, 1976; Dess and Beard, 1984; Randolph and Dess, 1984) referring to the extent of resources that are available to firms in their market and the amount of firms competing for them. In order to sustain in their market, firms that are dependent on acquiring external resources, a context that also links environment munificence to the resource dependency theory (Pfeffer and Salancik, 1978), seek to establish exchange relationships with other firms in an attempt to manage this dependency (Ulrich and Barney, 1984; Paulraj and Chen, 2007). Since social capital theory describes the underlying means for developing a relationship (Tsai and Ghoshal, 1998), a connection to environmental munificence can be found.
In terms of cognitive social capital, suppliers that possess all the resources to sustain and grow feel less attracted by a buying firm (Schiele et al., 2012) let alone by its internal alignment in terms of goals and values. While for suppliers operating in a resource scarce environment

perceived internal cognitive capital would paint the picture of a customer that is well equipped to deal with uncertain circumstances, and leading to the development of external cognitive capital, munificent suppliers would be less dependent on external relationships (Shou et al., 2013). Thus, these suppliers do not have the need to further develop external cognitive capital. Environmental munificence would therefore weaken the link between perceived internal cognitive capital and the development of external cognitive capital, leading to H4.1.

H4.1 The presence of environmental munificence negatively moderates the relationship between perceived internal cognitive capital and the development of external cognitive capital.

In order to evade resource scarcity, literature has indicated that firms should build up exchange relationships (Ulrich and Barney, 1984; Dyer and Singh, 1998). A way to deal with this is through developing structural ties that allow for effective communication (Villena et al., 2011). Suppliers operating in a resource scarce, non-munificent environment can therefore be expected to use every communication channel possible to secure their future growth (Starbuck, 1976). As such the perception of internal structural social capital present at their buying would signal that this customer has the communicative means in place that can be accessed to counteract environmental conditions. On the other hand, a supplier already operating in a munificent environment would only have to interact with their customer when necessary. The further development of external structural capital would therefore be less likely, despite the possible perception of internal structural capital, leading to H4.2.

H4.2 The presence of environmental munificence negatively moderates the relationship between perceived internal structural capital and the development of external structural capital.

Finally, since establishing relationships has been postulated of being a means to manage resource dependency (Ulrich and Barney, 1984; Paulraj and Chen, 2007), relational capital, through developing trust and commitment within a relationship, also plays a role when it comes to environmental munificence. Again, while suppliers operating in scarce environments would bind with their customers and develop external relational capital in order to sustain in the long-term, suppliers operating in a munificent environment might stick to a platonic business relationship since they are in no need to develop in depth relationships with their customer. Consequently, in munificent environments, the perception of internal relational capital would not per se lead to the development of external relational capital, which is depicted in H4.3.

H4.3 The presence of environmental munificence negatively moderates the relationship between perceived internal relational capital and the development of external relational capital.

3. RESEARCH METHODOLOGY

3.1 Data collection

With the goal of investigating the effect of perceived internal social capital on the emergence of external social capital, our research started off with a small-scale pre-study. In order to ensure that suppliers are indeed able to perceive the accumulation of internal social capital at their customer firm, a group of five experts from diverse departments, including R&D, Purchasing and Quality, of a multinational German automotive manufacturer located in China was interviewed:

The experts who were dealing with suppliers on a daily basis were given the questionnaire intended for the suppliers and had to comment on its feasibilty and ideally agree on it. The same procedure was repeated with two key-accountants selected from random suppliers. All experts confirmed the study applicability. Based on the positive outcome of the pre-study, a sample of 1386 suppliers was selected. The suppliers orginated from the portfolio of the German multinational. In order to minimize bias, suppliers from each commodity group dividing the purchasing department, including exterior, interior, metal, electric and powertrain, were equally selected. Eventually, 131 usable questionaires were received, equalling a response rate of 9%.

3.2 Measurements

The measurements used in this research were mostly adapted from previous studies. A conduction of in-depth interviews with experts from the German Multinational allowed for a subsequent further refinement. In terms of scaling, five-point Likert scales were used, ranging from 1=strongly disagree to 5=strongly agree. Perceived internal as well as external social capital were measured using the same items for ensuring comparability. Further, structural, cognitive and relational capital were broken down into three 2nd order constructs which could be measured individually, allowing for a finer grasp of the concept. Structural capital was then measured focusing on quantity and nature of interaction as well as means used for exchanging. Items from Villena et al. (2011) and Wang et al. (2013) were applied. The measurements for cognitive capital focused on whether goals and values are shared between parties, whether they overlap and whether corporate culture and management style match. Measures of Villena et al. (2011) and Yeung et al. (1991) were applied. Here the focus in particular lied on whether the corporate culture of both supplier and customer is comparable. Finally relational capital was meausred through a distinction into trust, commitment and reciprocity as outlined by Blonska et al. (2013). In terms of moderating factors, the measurement for environmental uncertainty was conducted by seperating between complexity, dynamism and munificence. Here, the items of Lau et al. (1999), Kaufmann (2012) and Li et al. (2013) were adapted for our purposes and applied.

3.3 Data analysis

To test the hypotheses, partial least squares structural equation modeling (PLS-SEM) was carried out (Fornell & Cha, 1994). In particular, the software SmartPLS (Ringle et al., 2005) was used to carry out a confirmatory factor analysis. The PLS approach has been characterized as useful for obtaining robust findings (Chin, 1998). Bootstrapping (Nevitt & Hancock, 2001) was applied to increase measurement accuracy to the used sample. The detailed path coefficients of our model can be found in Appendix I. Due to the reflective nature of our constructs, internal consistency and reliability were assessed using composite reliability (CR) (Fornell & Larcker, 1981; Wetzels et al., 2009) in combination with average variance extracted (AVE) and factor loadings (Edwards & Bagozzi, 2000). Individual item loadings were analyzed in order to assess indicator reliability: As it turned out, items of perceived as well as external social capital were strongly loading on each other, thus affecting each others explanatory power. This might have been due to the fact that same questions were posed for internal and external social capital as well as due to the high amount of indicators located to each construct. As a result, several items had to be removed, eventually leaving five items per construct. Further, one item with factor loading of 0.6 x was retained, all other loadings well exceed the threshold of 0.7 (Henseler et al., 2009). Focusing on convergent reliability, the analysis found that all items strongly correlate with the construct they

are related to. As such, all values exceed the threshold of 0.7 for CR, 0.5 for AVE and 0.7 for Cronbach's alpha (Edwards & Bagozzi, 2000; Fornell & Larcker, 1981). Further, the Fornell-Larcker criterion was used to test for discriminant validity. Also here, no concern was found (all see Appendix I). For assesing common method variance (CMV), the unmeasured latent methods factors test as described by Podsakoff et al. (2003) was conducted. A common method variance factor including all principal constructs indicators was introduced. As shown in table 3, the substantive variance averaged around 0.704 while the average method based variance was 0.020, resulting in a ratio of substantive to method based variance of 35:1. Following this result, CMV may not be regarded a concern

4. RESULTS AND CONCLUSION

Looking at the results the study at hand contributes, H1.1 (t = 12.626), H1.2 (t = 11.866) and H1.3 (t = 15.208) have been proven of having strong validity. As such, not only are suppliers well able to perceive the accumulation of internal social capital with their customer organization, but also this in turn leads them to build external social capital with their customer themselves. This postitive relationship between perceived internal and external social capital has not been found in literature so far and has an important implication for supplier management and B2B marketing: Buying firms are well adviced to consider how they appear in front of their suppliers, how they communicate and cooperate internally. Omitting this outside perspective might lead to a relationship between buyer and supplier with less trust, commitment and collaboration, which eventually could also result in decreased relationship output, e.g. success in common projects. Taking a look at H2, H3 and H4, the effect of environmental uncertainty of the relationship between perceived internal and external social capital, most of the hypotheses have found no support (see table 4): Only the relationship between perceived internal cognitive capital and external cognitive capital is moderated by environmental complexity (t = 1.747). In other words, under conditions of environemntal complexity, suppliers, who perceive that goals are aligned within their customer organization and values are shared, are more likely to also build cognitive capital with their customer, thus align their goals and values. For buying firms this implies that, whilst suppliers operate in complex markets, buying firms might find it easier to agree on goals with them and link values with their suppliers. Next to testing the hypotheses, and contrary to the logical assumption, also a positive direct relationship was found to exist between environmental munificence and external cognitive and relational capital. Apparently, suppliers who are sufficiently equipped and supported through the characteristics of the market they operate in, are more willing to commit to relationships with customers. One argument here could be that these suppliers are monopilists or oligopolists and simply more power and leverage on their customers so that they do not have to fear opportunistic behavior from their side. Future research should look into alternative antecedents or moderators refering to socal capital and also confirm our findings.

Appendix I – Statistics

Table 1: Fornell-Larcker Criterion

Latent variables	Ext SC cog.	Ext. SC rel.	Ext. SC str.	Per. SC cog.	Per. SC rel.	Per. SC str.	Env. Com.	Env. Dyn.	Env. Mun.	Con. size.	Con. com.	Con. pro.	Con. aff.
Ext. SC cognitive	**0.836**												
Ext. SC relational	0.798	**0.813**											
Ext. SC structural	0.596	0.628	**0.784**										
Per. SC cognitive	0.798	0.784	0.692	**0.868**									
Per. SC relational	0.763	0.799	0.659	0.792	**0.864**								
Per. SC structural	0.639	0.635	0.726	0.692	0.709	**0.795**							
Environ. Complex.	-0.063	-0.087	-0.093	-0.057	-0.088	-0.173	**0.847**						
Environ. Dynamism	-0.121	-0.124	0.001	-0.093	-0.064	-0.045	0.468	**0.722**					
Environ. Munif.	0.444	0.441	0.329	0.394	0.402	0.324	0.045	-0.028	**0.837**				
Con. size.	0.188	0.131	0.185	0.139	0.139	0.267	0.126	0.097	0.131	**1.000**			
Con. com.	-0.045	-0.018	0.017	-0.048	-0.086	0.075	-0.053	0.107	0.006	-0.045	**1.000**		
Con. prox.	-0.018	-0.025	-0.049	-0.026	-0.019	-0.036	0.138	-0.023	0.167	-0.229	0.124	**1.000**	
Con. affil.	0.040	0.099	0.120	0.128	0.086	0.049	0.077	-0.046	0.095	0.074	0.061	-0.075	**1.000**

Table 2: Item Loadings

Items	Ext SC cog.	Ext. SC rel.	Ext. SC str.	Per. SC cog.	Per. SC rel.	Per. SC str.	Env. Com.	Env. Dyn.	Env. Mun.	Con. size.	Con. com.	Con. pro.	Con. aff.

Ext.Cog1	**0.848**												
Ext.Cog2	**0.809**												
Ext.Cog3	**0.888**												
Ext.Cog4	**0.872**												
Ext.Cog5	**0.756**												
Ext.Rel1		**0.775**											
Ext.Rel5		**0.854**											
Ext.Rel7		**0.855**											
Ext.Rel8		**0.784**											
Ext.Rel9		**0.794**											
Ext.Str1			**0.750**										
Ext.Str2			**0.741**										
Ext.Str6			**0.820**										
Ext.Str7			**0.820**										
Ext.Str8			**0.788**										
Per.Cog2				**0.823**									
Per.Cog5				**0.840**									
Per.Cog6				**0.924**									
Per.Cog7				**0.926**									
Per.Cog8				**0.820**									
Per.Rel2					**0.899**								
Per.Rel3					**0.899**								
Per.Rel4					**0.866**								
Per.Rel6					**0.786**								
Per.Rel7					**0.847**								
Per.Str1						**0.809**							
Per.Str3						**0.771**							
Per.Str7						**0.761**							
Per.Str9						**0.834**							
Per.Str11						**0.797**							
Compl.2							**0.730**						
Compl.3							**0.863**						
Compl.4							**0.936**						
Dynam.1								**0.706**					
Dynam.2								**0.610**					
Dynam.4								**0.833**					
Munif.2									**0.782**				
Munif.3									**0.847**				
Munif.4									**0.879**				
Con. Size										**1.000**			
Con. Com.											**1.000**		
Con. Prox												**1.000**	
Con. affil.													**1.000**

Table 3: Common Method Variance

Loadings	*Construct loading (CL)*	*CL^2*	*Method factor loading (MFL)*	*MFL^2*
Ext.Cog1	0.950	0.903	-0.106	0.011
Ext.Cog2	1.124	1.263	-0.342	0.117
Ext.Cog3	0.811	0.658	0.084	0.007
Ext.Cog4	0.696	0.484	0.197	0.039
Ext.Cog5	0.603	0.364	0.157	0.025
Ext.Rel1	0.689	0.475	0.093	0.009
Ext.Rel5	0.946	0.895	-0.099	0.010
Ext.Rel7	0.831	0.691	0.024	0.001
Ext.Rel8	0.455	0.207	0.358	0.128
Ext.Rel9	1.134	1.286	-0.367	0.135
Ext.Str1	0.825	0.681	-0.069	0.005
Ext.Str2	0.736	0.542	0.026	0.001
Ext.Str6	0.779	0.607	0.049	0.002
Ext.Str7	0.791	0.626	0.020	0.000
Ext.Str8	0.794	0.630	-0.029	0.001
Per.Cog2	0.561	0.315	0.281	0.079
Per.Cog5	0.823	0.677	0.019	0.000
Per.Cog6	1.024	1.049	-0.106	0.011
Per.Cog7	0.918	0.843	-0.110	0.012
Per.Cog8	0.991	0.982	-0.066	0.004
Per.Rel2	0.992	0.984	-0.025	0.001
Per.Rel3	0.850	0.723	0.054	0.003
Per.Rel4	0.936	0.876	-0.054	0.003
Per.Rel6	0.951	0.904	-0.182	0.033
Per.Rel7	0.669	0.448	0.192	0.037
Per.Str1	0.722	0.521	0.083	0.007
Per.Str3	0.806	0.650	-0.056	0.003
Per.Str7	0.657	0.432	0.193	0.037
Per.Str9	0.950	0.903	-0.158	0.025
Per.Str11	0.855	0.731	-0.075	0.006

Compl.2	0.753	0.567	0.114	0.013
Compl.3	0.886	0.785	0.000	0.000
Compl.4	0.901	0.812	-0.092	0.008
Dynam.1	0.924	0.854	-0.034	0.001
Dynam.2	0.911	0.830	0.051	0.003
Dynam.4	0.398	0.158	-0.036	0.001
Munif.2	0.827	0.684	-0.042	0.002
Munif.3	0.817	0.667	0.035	0.001
Munif.4	0.869	0.755	0.004	0.000
Average	***0.824***	***0.704***	***-0.0004***	***0.020***

Table 4: Construct Reliability and Validity

Latent Variable	*Cronbach's Alpha*	*rho_A*	*Composite Reliability*	*Average Variance Extracted*
External SC - cognitive	0.891	0.897	0.920	0.699
External SC - relational	0.871	0.875	0.907	0.661
External SC - structural	0.844	0.849	0.889	0.615
Perceived SC - cognitive	0.917	0.917	0.938	0.753
Perceived SC - relational	0.915	0.918	0.936	0.747
Perceived SC - structural	0.855	0.868	0.894	0.631
Environmental Complexity	0.803	0.917	0.883	0.718
Environmental Dynamism	0.704	0.721	0.763	0.522
Environmental Munificence	0.787	0.804	0.875	0.700
Control Variable - Size	1.000	1.000	1.000	1.000
Control Variable - Commodity	1.000	1.000	1.000	1.000
Control Variable - Proximity	1.000	1.000	1.000	1.000
Control Variable - Affiliation	1.000	1.000	1.000	1.000

Table 5: Path Coefficents

Path / Hypothesis	*Path coefficient*	*t-value*	*p-value*
Perceived cognitive SC → External cognitive SC (**H1.1**)	0.731	12.626	< 0.001, significant
Perceived structural SC → External structural SC (**H1.2**)	0.704	11.866	< 0.001, significant
Perceived relational SC → External relational SC (**H1.3**)	0.748	15.208	< 0.001, significant
Moderation: Complexity → Cognitive SC (**H2.1**)	-	1.747	< 0.1, significant
Moderation: Complexity → Structural SC (**H2.2**)	-	0.397	> 0.1, non-significant
Moderation: Complexity → Relational SC (**H2.3**)	-	0.022	> 0.1, non-significant
Moderation: Dynamism → Cognitive SC (**H3.1**)	-	0.664	> 0.1, non-significant
Moderation: Dynamism → Structural SC (**H3.2**)	-	0.219	> 0.1, non-significant
Moderation: Dynamism → Relational SC (**H3.3**)	-	0.086	> 0.1, non-significant
Moderation: Munificence → Cognitive SC (**H4.1**)	-	0.756	> 0.1, non-significant
Moderation: Munificence → Structural SC (**H4.2**)	-	0.814	> 0.1, non-significant
Moderation: Munificence → Relational SC (**H4.3**)	-	0.076	> 0.1, non-significant
Further significant paths			
Munificence → External cognitive SC	0.161	2.655	< 0.01, significant
Munificence → External relational SC	0.138	2.345	< 0.1, significant

Appendix II – Measures

Internal Structural Capital:

	During the project, departments at your customer firm…	
Infrastructure Actor Exchange	• Always conducted common activities / workshops. • Had common project reviews in place. • Used internal linking systems (shared fileserver etc.). • Had also purely social activities (common meals, after-work get togethers). • Made use of being located in close proximity to each other.	Own measure
Quantity of Interaction	• Frequently communicated with each other. • Frequently communicated at different levels (management, operative staff etc.). • Frequently communicated between different functions.	Villena (2011); CR: 0.87; AVE: 0.68
Nature of Communication	• Exchanged concessions throughout the project (e.g. granted more time etc.). • Solved / prevented problems commonly. • Easily found agreements jointly. • Constructively addressed topics that could entail conflicts.	Wang et al. (2013); alpha: 0.8

Internal Cognitive Capital:

	During the project, departments at your customer firm…	
Shared Norms & Values	• Interpreted situations in the same way / had the same approaches to business dealings. • Had a common understanding about what is allowed / not allowed. • Had the same vision of business in the relationship. • Viewed each other as partners.	Villena (2011); CR: 0.8; AVE: 0.5
Overlap of Objectives	• Were aware of each other's objectives / KPIs. • Were aligned on objectives / objectives matched. • Made the effort to align goals. • Had similar targets.	. Own measure

Internal Relational Capital:

	During the project, departments at your customer firm…	
Trust	• Considered own interests as well as the others. • Trusted in each other to keep the best interest in mind. • Counted on each other to follow through with promises..	Blonska (2013); CR: 0.87, AVE: 0.69
Commitment	• Found it pleasant to work with each other, which is why the relationship continued. • Wanted to remain in the relationship. • Were attracted by what the other party represented as a firm (image, brand, reference etc.).	Blonska (2013); CR: 0.86, AVE: 0.66
Reciprocity	• Considered the relationship as mutually beneficial. • Felt indebted because of what the other had done for each other. • Expected to also work on further projects in the future.	Blonska (2013); CR: 0.81; AVE: 0.69

External Structural Capital:

	During the project, you and your customer…	
Infrastructure Actor Exchange	• Always conducted common activities / workshops. • Had common project reviews in place. • Used internal linking systems (shared fileserver etc.). • Had also purely social activities (common meals, after-work get togethers). • Made use of being located in close proximity to each other.	Own measure
Quantity of Interaction	• Frequently communicated with each other. • Frequently communicated at different levels (management, operative staff etc.). • Frequently communicated between different functions.	Villena (2011); CR: 0.87; AVE: 0.68
Nature of Communication	• Exchanged concessions throughout the project (e.g. granted more time etc.). • Solved / prevented problems commonly. • Easily found agreements jointly. • Constructively addressed topics that could entail conflicts.	Wang et al. (2013); alpha: 0.8

External Cognitive Capital:

	During the project, you and your customer…	
Shared Norms & Values	• Interpreted situations in the same way / had the same approaches to business dealings. • Had a common understanding about what is allowed / not allowed. • Had the same vision of business in the relationship. • Viewed each other as partners.	Villena (2011); CR: 0.8; AVE: 0.5
Overlap of Objectives	• Were aware of each other's objectives / KPIs. • Were aligned on objectives / objectives matched. • Made the effort to align goals. • Had similar targets.	. Own measure

External Relational Capital:

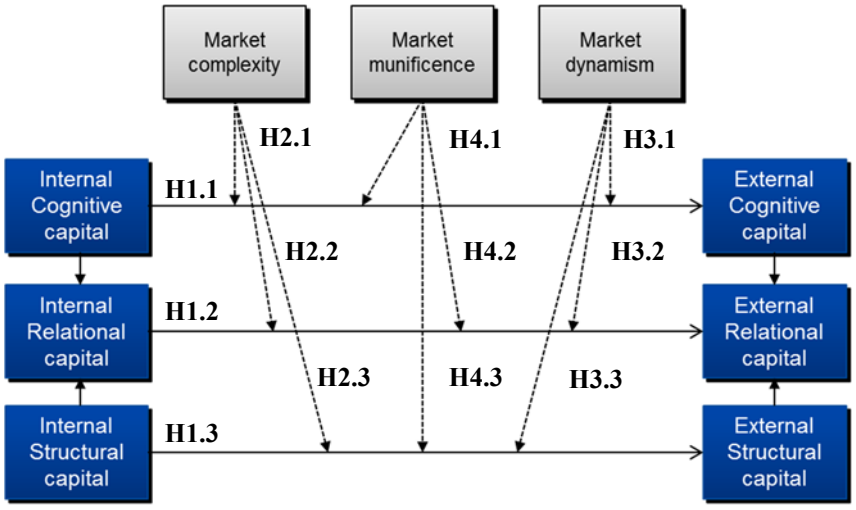
	During the project, you and your customer…	
Trust	• Considered own interests as well as the others. • Trusted in each other to keep the best interest in mind. • Counted on each other to follow through with promises..	Blonska (2013); CR: 0.87, AVE: 0.69
Commitment	• Found it pleasant to work with each other, which is why the relationship continued. • Wanted to remain in the relationship. • Were attracted by what the other party represented as a firm (image, brand, reference etc.).	Blonska (2013); CR: 0.86, AVE: 0.66
Reciprocity	• Considered the relationship as mutually beneficial. • Felt indebted because of what the other had done for each other. • Expected to also work on further projects in the future.	Blonska (2013); CR: 0.81; AVE: 0.69

Environmental Uncertainty:

	In our market…	
Complexity	• It is difficult to compare firms / competitors. • The structures of firms / competitors are complex and difficult to understand. • It is complex and difficult to compare offers / products from different firms / competitors. • It is complex and difficult to compare the supply chains of different firms / competitors.	Lau (1999) alpha: 0.67
Dynamism	• A number of changes occur in the structure of firms / competitors over time. • A number of changes occur in the supply chains of firms / competitors over time. • It is very difficult to predict how the market will be in 2-3 years. • The barriers to enter are high / it is very difficult to enter the market.	Kaufmann (2012)
Munificence	• We are without external threat for survival and future development • We are with sufficient capital supply • We are with numerous profit opportunities • We can easily access the needed resources for operation and expansion	Li (2013); AVE: 0.55; alpha: 0.88

Appendix III – Figures

Figure 1: Research Model



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The effect of supplier satisfaction and the preferred customer status on successful project outcomes in China – A social capital perspective

Tobias Bohnenkamp, Holger Schiele and Matthias De Visser
University of Twente, The Netherlands

Abstract

Given a fundamental change in supply chain organization buying firms increasingly have to deal with a smaller number of key suppliers that employ extended value adding responsibilities. Buying firms thus have to pay attention to establish relationships with these suppliers in order to prevent the risk of resource scarcity. Satisfying suppliers and ideally becoming their preferred customer becomes top priority for buying firms in order to out-compete the competition. Before this becomes possible, however, firms are in need to establish relationships with their suppliers. Given its strong focus on social relations, having a foundation of well established relationships might be especially crucial for firms operating in China. In literature, social capital theory has been considered for studying relationships between buyer and supplier, however without quantitatively linking it to the concepts of supplier satisfaction and the preferred customer. This study therefore tries to establish this link. Further, through focusing on the Chinese market the study allows to test the effect of supplier satisfaction and the preferred customer in a low-cost country context, in particular on the success of projects with local Chinese suppliers.

Keywords: Social capital, supplier satisfaction, preferred customer status

1. INTRODUCTION

Reflecting upon the increased recognition that inter-organization ties have gained over the last decades in terms of contributing to the creation of value, buyer-supplier relationships have been considered more and more as a source of a sustainable competitive advantage (Krause et al., 2007). Forming and maintaining these relationships however is often seen challenging and considered rather complex (Johnston et al., 2004; Narasimhan and Nair, 2005). Yet, since companies increasingly outsource activities to their suppliers and thus grant them more responsibilities (Schiele et al., 2015) while their supply bases consolidate and include smaller numbers of key suppliers (Eggert and Ulaga, 2010), being able to successfully manage relationships becomes a necessary requirement. In fact, given that suppliers have constraints on capacities and resources they can devote to their customers (Huettinger et al., 2014), supplier scarcity becomes a risk for firms they have to mitigate (Bode et al., 2011). As such, creating satisfaction among the suppliers and in turn being considered their preferred customer can be a solution (Schiele et al., 2011; Schiele et al., 2012; Ellis et al., 2012).

Here, in order to answer the question of how supplier satisfaction can be achieved, Huettinger and colleagues (2014) identified 28 antecedents that firms should consider. One year later, Schiele et al. (2015) approached this from a more theoretical standpoint, proposing a link between supplier satisfaction and the presence of social capital. From the theoretical perspective, social capital theory has been considered for studying relationships between individuals and organizations (Ahuja, 2000; Tsai and Ghoshal, 1998). With social capital being present in an inter-organization relationship between buyer and supplier, the exchange of resources can be facilitated (Hughes and Perrons, 2011) and performance increased (Lawson et al., 2008; Whipple et al., 2015). Literature further suggests that social capital allows both buyers and suppliers to access and leverage resources tied within the relationship (Villena et al., 2011). Accordingly, the presence of social capital reduces the risk of conflicts and contrarily promotes cooperative behavior due to shared visions and trusting relations it emphasizes. Given this, social capital can surely be considered a piece of the puzzle for the necessary supplier satisfaction.
To this date, however research has not yet empirically tested a relationship between social capital and supplier satisfaction (Schiele et al., 2015). This is unfortunate, given that the strong reliance on capable though scarce suppliers would demand an even clearer understanding on how to satisfy them. Consequently, in order to fill this research gap, this study will aim to answer the following research question:

How does social capital present in a relationship influence supplier satisfaction?

Through doing so, this study will therefore try to quantitatively establish a link between social capital, supplier satisfaction and, with it, also the preferred customer status. A context, where this configuration based on social capital can be considered very important, is China, given its strong focus on social relations (Li et al., 2014). Since China has become the most important supplier market in the world, companies increase their efforts to integrate domestic suppliers into their sourcing activities for accessing the potential of the local supplier base and, predominantly for foreign companies located in China, to fulfil local content requirements (Lockström and Lei, 2013). Unfortunately, as indicated by empirical evidence, many foreign companies struggle when it comes to sourcing from domestic suppliers and building long-term relationships with them (Lockstroem et al., 2010; Kotabe and Murray, 2004; Pyke et al., 2000; Millington et al., 2005). Such a condition might also affect common projects between buyer and local suppliers, which are in many cases not only one-time activities. Following our prior stream of reasoning, project success might therefore depend on the firm's ability to accumulate social capital, achieve supplier satisfaction and eventually become preferred customer of the supplier. Especially understanding the relationship between preferred customer ship and successful project outcomes with local suppliers could be of strong interests for firms operating in China: Given the strong need to build a domestic supply base, or in other words to "localize", enforced through governmental requirements (Lockstrom et al., 2011; Nassimbeni and Sartor, 2007; Eberhardt et al., 2004), firms would have to strongly cooperate with their suppliers in order to catch up a loss in terms of quality or competitiveness. This could even go as far as collaborating with suppliers to implement local sub-tier suppliers into their supply chains for achieving certain local content rates. Through becoming preferred customer, firms could grant access to external resources (Schiele et al., 2012), that might even include a direct line to sub-tier suppliers. Thus, being preferred customer might have advantages, especially when dealing local Chinese suppliers. Literature however has not yet considered the preferred customer status in the Chinese context. Again, this gap in literature is unfortunate, given that in Chinese society with its strong reliance on Guanxi, a form of social

capital (Yang, 1994; Nie et al., 2011), being preferred customer could have a reverse effect: Suppliers might feel less challenged to deliver outstanding results due to the already established Guanxi with their customer (Nie et al., 2011). In other words, while a high accumulation of social capital could positively affect supplier satisfaction and the preferred customer status, the implication might not be the same for successful project outcomes in China. In order to shed light on this situation, the following research question is formulated:

> *How does the preferred customer status affect the outcome of projects with local Chinese suppliers?*

Through answering the two research questions, our study will contribute in two directions: (1) Through quantitatively testing the link between the presence of social capital and supplier satisfaction, our study will further extend social capital theory towards a framework of resource mobilization in buyer-supplier relationships. As such, through employing social capital as antecedent to supplier satisfaction, firms might find another means, grounded on theory, to build relationships with their suppliers going beyond the common business context, to eventually access external resources that are not available to competitors. Further, through surveying suppliers we will follow the call for more research on social capital from the supplier perspective (Gelderman et al., 2016).
(2) Focusing on the Chinese market, our study will extend research on supplier satisfaction and the preferred customer status to a new context. Here, especially the relationship between being preferred customer of a supplier and succeeding in common projects is of strong interest. Since the preferred customer status has not been tested in another cultural setting, its applicability might also differ which could lead to strong implications for firms operating in China. Thus, our study will fill another research gap.
The paper will be organized as follows: Through conducting an extensive literature review, all variables will be introduced. Subsequently, the focus will lie on the research methodology, findings will be presented and discussed, and eventually with concluding the paper, future research possibilities and limitations of our study will be presented.

2. THEORETICAL CONSIDERATIONS

2.1 Social capital theory: Cognitive, structural and relational capital define the concept

Social capital theory, having its roots in sociology, is grounded on social relations that underlie relationships between individuals and groups (Adler and Kwon, 2002). As such it refers to resources, of actual or potential nature that include contextual factors on which the resource exchange is based and that can be accessed by different actors within a relationship (Nahapiet and Ghoshal, 1998; Kankanhalli et al., 2005). Since those resources are not of physical nature but contained in the relations between parties, social capital accumulated in social ties is difficult to imitate and has the potential to create a competitive advantage (Edelman et al., 2004). In academics the notion of social capital has been used as theoretical lens for studying relationships between individuals and organizations (Ahuja, 2000; Tsai and Ghoshal, 1998), or at more recent state in the field of supply management focusing on buyer and supplier interactions (Hartmann and Herb, 2014; Horn et al., 2014). It is further distinguished into three dimensions including (1) cognitive capital, (2) structural capital and (3) relational capital (Nahapiet and Ghoshal, 1998). Whereas the majority of studies examine these dimensions as in parallel existing

constructs, others also consider cognitive and structural capital as antecedents of relational capital (Carey et al., 2011; Horn et al., 2014; Preston et al., 2016). A form of social capital that can strongly be found in the Chinese context is Guanxi (Yang, 1994). Having its roots as a cultural construct, Guanxi has been proven valuable within business relationships and consequently studied extensively over the last decade (Yang and Wang, 2011). Through incorporating social embeddedness (Ring and Van de Ven, 1994; Granovetter, 1985), Guanxi is built on inter-organizational trust that can resolve conflicts (Nicholson et al., 2001) (Carolyn et al., 2002) and allows firms to pursue long-term oriented goals (Dunning and Kim, 2007). Similar to the general understanding of the social capital concept, Guanxi is based on the assumption that common norms and social interactions enable firms to establish bonds and linkages that can influence their performance (Nie et al., 2011).

The cognitive dimension of social capital refers to common values and visions that relationship partners share (Tsai & Ghoshal, 1998). They also include common goals, norms and beliefs contributing to the understanding of the social system, as well as shared interpretations, such as language or signs (Uphoff and Wijayaratna, 2000; Tsai and Ghoshal, 1998). A high level of cognitive capital therefore implicates that these attributes are shared by both relationship partners to a high extent. In this way, cognitive capital enables a consensus on strategic goals and processes that both parties might benefit from (Adler and Kwon, 2002; Atuahene-Gima and Murray, 2007). In fact, as determined by Gelderman (2016), compared with the other two dimensions, shared cognitive capital exerts the biggest impact on the strategic performance of suppliers. Roden and Lawson (2014) on the other hand, while examining the configurations of the social capital dimensions, provide evidence that relationship adaptations might substitute for cognitive capital.

Within the social context of relationships, patterns of connections between parties exist. These patterns of connections are understood as structural capital which defines how they can be used and how frequent they occur (Burt, 1997; Villena et al., 2011), or, as Nahapiet and Ghoshal (1998) put it, “who you reach and how you reach them” (p. 244). A high level of structural capital can therefore be found if both actors within a relation utilize multiple channel of interaction to facilitate the information and resource exchange (Koka and Prescott, 2002; Villena et al., 2011; Zaheer and Bell, 2005). In other words, the common usage of resources is enhanced through clarity, transparency on actions and processes fostered by a strong and consistent flow of information. This is stressed by empirical findings reporting the positive effect of structural capital on “information flow” and “information diversity” (Koka and Prescott, 2002). Consequently, while structural capital, for example in terms of means to communicate, can benefit the relationship between actors, its complete absence has negative consequences (Villena et al., 2011).

Relational capital is expressed by trust, friendship and mutual respect between the partners (Kale et al., 2000; Carey et al., 2011) as well as reciprocity (Mathwick et al., 2007). The content is based on the works of Granovetter and Swedberg (1992) focusing on embeddedness and relationships people have developed with each other. Relational capital is built through exchanges between relationship partners (Blonska et al., 2013) and considered as being closely connected to the dimensions of structural and cognitive capital. Arguably, if parties in a relationship share common business goals and ideas as well as holding a dense net of interactions, relational capital might be more likely to develop (Tsai & Ghoshal, 1998). Since both parties are expected to regard each other as more trustworthy than those with whom they do not have any commonalities, the finding is comprehensible. In the same way, a relationship based on trust requires frequent interaction and the means to do so. Interestingly, if trust and commitment are present, the

information flow and intensity are increased (Hartmann and Herb, 2014).
The next section will now focus on the concept of supplier satisfaction as well as its relation to the preferred customer status.

2.2 Supplier satisfaction and the preferred customer status

Satisfaction within a relationship is understood as the perceived feeling of fulfillment when certain goals, targets or simply outcomes are achieved (Benton and Maloni, 2005; Essig and Amann, 2009). For several decades, literature has only considered satisfaction from the customer point of view (Dwyer et al., 1987; Walter et al., 2003) as crucial for business success, whereas the focus on satisfaction of suppliers has been neglected. Only by the beginning of the new century, research more and more began to comprehend the value that supplier satisfaction can contribute to firm competitiveness (Wong, 2000; Benton and Maloni, 2005; Schiele et al., 2012; Hüttinger et al., 2014; Pulles et al., 2016). By definition, supplier satisfaction emerges if the outcome from the relationship with the buying firm meets or exceeds the expectations of the supplier (Schiele et al., 2012). As such, it relates to a positive evaluation of the working relationship both parties have (Dwer et al., 1987; Huettinger et al., 2014). In other words, supplier satisfaction results from the perceived value in the relationship between the supplier and his customer (Pulles et al., 2016). Several studies have since paid attention to the antecedents of supplier satisfaction, i.e. the conditions that firms can provide to achieve a state of relationship that causes supplier to be satisfied: Whereas Benton and Maloni (2005) pay attention to mediated power sources that can promote supplier satisfaction, Leenders et al (2005) consider tools such as the establishment of long-term commitments or internal information sharing as means to facilitate supplier satisfaction. Others, such as Ghijsen et al. (2010) focus on direct and indirect strategies that buying firms can employ in order to increase the level of satisfaction among their suppliers. Huettinger et al. (2014), based on a literature review, go as far as outlining 28 antecedents that can affect supplier satisfaction. Though, no matter which suggestion to follow, once supplier satisfaction is achieved, buying firms have the opportunity to profit from a preferential resource allocation, being considered their suppliers preferred customer (Steinle and Schiele, 2008).
As put by Schiele et al., (2012), the preferred customer concept can be considered a mirror of the notion introduced by Trent (2005) who discussed the “preferred supplier”. The preferred customer concept is based on the idea that buying firms are able to influence their suppliers behavioral intentions in order to be awarded with a status allowing them to receive favorable treatment over other firms (Schiele et al., 2012). Examples of this favorable treatment could include first offering of new ideas and innovations, preferred resource allocation in case of capacity shortages or the delegation of the best personnel to common projects (Bew, 2007; Steinle and Schiele, 2008). In this sense the preferred customer status, from a strategic point of view, through combining external resources (Dyer and Singh, 1998), can provide firms with an advantage over competitors enabling them to achieve higher performance outcomes (Pulles et al., 2016). Blonska (2010), while studying the effect of supplier development investments on becoming preferred customer, also found a link between the presence of social capital and the preferred customer status, considering social capital a mediator.
The next section will now use the theoretical basis that was outlined before to build hypotheses concerning relationships between the introduced concepts.

2.3 Hypotheses

As introduced before, cognitive social capital can be closely related to the sharing of goals and values between parties in a relationship (Tsai and Ghoshal, 1998; Villena et al. 2011). As such, if the goals and values of both parties correspond to a high extent, a high level of cognitive capital is present. Consequently, buyer and supplier that share both attributes are able to develop an understanding of each other's processes, strategies and long-term targets (Adler and Kwon, 2002) that can be beneficial for the own as well as common planning activities. Further, the presence of cognitive capital might thus also go in line with a certain degree of similarity in terms of corporate culture. As shown by Parkhe (1993), such a similarity has a positive effect on business success of a buyer-supplier relationship. Next to this, the reduction of opportunistic behavior is then also seen as a key benefit (Ouchi, 1980; Villena et al., 2011). Also, as shown by Gelderman (2016), the presence of cognitive capital strongly impacts the strategic performance of suppliers. Following this reasoning, H1.1 has been formulated.
Structural capital on the other hand has been depicted as pattern of connections between firms (Villena et al., 2011). Utilizing these structural ties, such as the sharing of information, external resources can be accessed (Dyer and Singh, 1998) that might have the potential to create a competitive advantage. Since especially the exchange of the right information at the right time is considered important, dense social structures between parties have been argued of being highly beneficial for firms (Zaheer and Bell, 2005). Also, information accuracy and reliability can be achieved in this way (Chen et al., 2009; Villena et al., 2011). As such, structural social capital through providing the means of exchanging knowledge with the right people at the right time (Nahapiet and Ghoshal, 1998) enables intensifying cooperation and collaboration between buyer and supplier, which has been assumed to positively impact satisfaction among suppliers (Essig and Amann, 2009). Consequently and based on this reasoning, H1.2 has been formulated.
Finally, in terms of relational social capital, trust and commitment (Zhao and Cavusgil, 2006; Villena et al., 2011) as well as reciprocity (Blonska, 2013) have been argued to be the defining factors. Being closely connected to cognitive and structural social capital, relational capital is considered to prevent the risk of opportunistic actions as well as leakages of knowledge (Kale et al., 2000). As such, it can be considered likely to increase supplier satisfaction, since the supplier has to fear fewer risks. In their study in 2010, Nyaga et al. further discover that while collaborative activities positively affect supplier satisfaction, trust and commitment function as mediators. Consequently, since relational capital is grounded on both attributes, it is fair to argue that relational capital itself also positively influences the emergence of supplier satisfaction. Thus H1.3 has been formulated.

H1.1 The presence of cognitive social capital in the relationship between buyer and supplier positively influences the emergence of supplier satisfaction.

H1.2 The presence of structural social capital in the relationship between buyer and supplier positively influences the emergence of supplier satisfaction.

H1.3 The presence of relational social capital in the relationship between buyer and supplier positively influences the emergence of supplier satisfaction.

Once supplier satisfaction has been achieved, buyers might profit from preferential treatment of its supplier. In fact, (Hüttinger et al., 2012) Huettinger et al. (2012) empirically tested and proved that supplier satisfaction is positively related to becoming preferred customer. As has been described before, the preferred customer concept refers to the underlying assumption that suppliers are restricted by a limited amount of resources they can provide to their customers and that these customers may not be treated equally in terms of resource allocation (Mitsuhashi and Greve, 2009). Consequently, some customers receive favorable allocation while others have to rely on the remainder (Dyer and Hatch, 2006). Therefore, since obtaining better resources relative to competitors might result in a competitive advantage (Hult et al., 2006; Capron and Chatain, 2008), firms must pay attention to the moves of other firms in the supply base and aim to outcompete them for achieving preferential resource allocation themselves (Ellram et al., 2013; Steinle and Schiele, 2008; Schiele, 2012).
Firms that are able to be awarded the preferred customer status from their suppliers, have several advantages that might become valuable during common projects: The most obvious advantage of course is the preferential treatment in terms of resource allocation (Bew, 2007). This does not only refer to the suppliers themselves but also to the human capital, the personnel that is assigned to the preferred customer (Steinle and Schiele, 2008). Arguably, if more expertise and knowledge in form of "better" employees is accumulated, also common projects between buyer and supplier are more likely to succeed. Having the best employees assigned to a project could be especially crucial in China where foreign firms struggle with e.g. quality standards of local suppliers (Wilkinson et al., 2005; Lockstroem et al., 2010). High knowledgeability could increase the chance of success. Further, being preferred customer also comes with the benefit of unique cost saving opportunities (Bew, 2007). The suppliers might apply a more benevolent pricing behavior (Schiele et al., 2011). While this itself does not seem likely to affect project outcomes in a direct way, buyers might have to pay less, not only for the product itself, but also in form of invest intended for e.g. the suppliers tooling's necessary for production lines. Consequently, spending less money is more likely to lead to a positive business case which in turn could also influence whether a project is approved and successful, or not.
Arguably though, and as has been described before, when dealing with suppliers located in China the preferred customer status, due to its strong underlying connection to social exchanges and relations (Huettinger et al., 2014), might be established as a result of emerging Guanxi between buyer and supplier. Guanxi itself has been proofed to decrease supplier performance and increases the risk of opportunistic actions (Nie et al., 2011). This is in line with the research of Villena and colleagues (2011) focusing on the dark side of buyer-supplier relationships. They determined that identification-based trust resulting from (high levels of) accumulated social capital can entail the risk of opportunism. Their findings were later on confirmed by Wang et al. (2013). As such, through building the preferred customer status on a high accumulation of social capital in China, its possible positive effect might diminish. However, since a clear contribution of the preferred customer to firm value creation has been found (Huettinger et al., 2012), we formulate H2.2, despite being curious about whether it might hold. Also, in order to close our line of reasoning, we re-examine whether supplier satisfaction also affects becoming preferred customer with local Chinese suppliers, leading to H2.1.

H2.1 The presence of supplier satisfaction among local Chinese supplier positively influences the reception of the preferred customer status.

H2.2 The preferred customer status positively influences project outcomes with local Chinese suppliers.

The next section will now introduce the methods used in our study to test the hypotheses. As such, the background of data collection as well as the applied measurements are introduced.

3. RESEARCH METHODOLOGY

3.1 Data collection

The aim of the paper is to investigate the links between the social capital dimensions and supplier satisfaction as well as between the preferred customer status and outcomes of common projects between buyer and supplier in China. For this purpose, a sample of 1386 suppliers located in China was randomly selected. All of the suppliers are operating in the automotive industry and can be equally divided among the five automotive commodity groups including interior, exterior, metal, electric and powertrain. The automotive industry was chosen as the setting of our study for the major role it is playing in the world economy (Taylor and Taylor, 2009). Also, the automotive industry, due to its high requirements in terms of quality as well as intellectual property protection (Holweg et al., 2008), poses challenges for the establishment of relationships while simultaneously assigning relationships between buyer and supplier a crucial role (Lockstroem, 2010). Consequently, the setting fits nicely to our research goal.
The suppliers were then approached via email containing a link to a web portal. Here, they had the option to answer questions in the English or Chinese language. This was done to ensure that even non-English speaking local Chinese suppliers had the chance to participate. For guaranteeing that the implication of English and Chinese questions matched to the fullest and did not lose meaning in the translation process, two independent Chinese native speakers were involved: The first native speaker translated the English questions into Chinese, while the second native speaker translated them back into English. Afterwards, the original and back-translated English questions were compared, which resulted in minor adjustments of the Chinese translation. Eventually, 131 usable questionaires were received, equalling a response rate of 9%.

3.2 Measurements

The measurements used in this research were mostly adapted from previous studies. A conduction of in-depth interviews with experts from the German Multinational allowed for a subsequent further refinement. In terms of scaling, five-point Likert scales were used, ranging from 1=strongly disagree to 5=strongly agree. The measurement items as well as the values of Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) can be found in Appendix I. For measuring social capital, the concept was firstly broken down into its three dimension, cognitive capital, structural capital and relatonal capital. Subsequently they were broken down into three 2nd order constructs which could be measured individually, allowing for a finer grasp of the concept. Structural capital was then measured focusing on quantity and nature of interaction as well as means used for exchanging information. Items from Villena et al. (2011) and Wang et al. (2013) were applied. The measurements for cognitive capital focused on whether goals and values are shared between parties and whether they overlap. Measures of Villena et al. (2011) were applied. Finally relational capital was meausred through a distinction into trust,

commitment and reciprocity as outlined by Blonska et al. (2013). In order to measure supplier satisfaction, the items of Huettinger et al. (2014) were used. Here the focus especially lied on whether working with the business partner was pleasant and whether the decision to cooperate would be taken again. Focusing on the preferred customer concept, measures developed by Schiele et al. (2012) were utilized. Measures here were strongly focusing on the status that the customer has for the supplier, whether the supplier dedicated the best resources to its customer and whether the customer was treated with higher prioritiy than others. Finally, the measures for project success, thus whether the goals of the project were achieved and whether it was conducted in a timely manner, were taken from Horn et al. (2014).

3.3 Data analysis

For testing the hypotheses we carried out a partial least sqaures equation modelling, short PLS-SEM (Fornell & Cha, 1994). For this purpose, the software SmartPLS, which has been characterized as frutiful for obtaining robust findings (Chin, 1998), was utilized (Ringle et al., 2005), in partcular for carrying out the confirmatory factor analysis. In order to increase the measurement accuracy of the sample, bootstrapping was applied (Nevitt & Hancock, 2001). Appendix I includes the detailed path coefficients as well as the t-values. For assessing internal consistency and reliability of our constructs, compsite reliability (CR) as well as avergage variance extracted (AVE) and factor loadings were used (Fornell and Larcker, 1981; Wetzels et al, 2009; Edwards and Bagozzi, 2000). The assessment of the indicator reliabilty was conducted by analyizing individual item loadings: As it turned out, due to the high amount of indicators located to the social capital constructs, some items were loading on each other, thus affecting each others explanatory power, and had to be removed. Further, two items with factor loadings of 0.6x were retained, all other loadings well exceed the threshold of 0.7 (Henseler et al., 2009). In terms of convergent reliability, the analysis showed that all items strongly correlate with the construct they are related to. As such, all values exceed the threshold of 0.7 for CR, 0.5 for AVE and 0.7 for Cronbach's alpha (Edwards & Bagozzi, 2000; Fornell & Larcker, 1981). Additionally, in order to test for discriminant validity, the Fornell-Larcker criterion (Fornell and Larcker, 1981) was used: Since the squared roots of the AVE scores are all larger than cross-correlations scores, no concern was found. For assesing common method variance (CMV), the unmeasured latent methods factors test as described by Podsakoff et al. (2003) was conducted. As such, a common method variance factor including all principal constructs indicators was introduced. As shown in table 11, the substantive variance averaged around 0.661 while the average method based variance was 0.018, resulting in a ratio of substantive to method based variance of 37:1. Following this result, CMV may not be regarded a concern .

4. RESULTS AND CONCLUSION

The study at hand paid attention to social capital theory and its role as antecedent of supplier satisfaction. As such, we in particular considered the three dimensions of social capital, namely cognitive, structural and relational capital and the effect their have on the development of a relationship a supplier would consider satisfying. Hypotheses 1.1 to 1.3 therefore suggested that every dimension of social captial would positively influence the emergence of supplier statisfaction, as has been proposed by past research (e.g. Essig and Amann, 2009) . Our findings however reveal a different picture: Both, the relationship between cognitive and supplier satisfacton ($t = 1.158$) as well as between structural capital and supplier satisfaction ($t = 0.935$)

have found to be insignificant. Relational capital on the other hand can be depicted to strongly affect the emergence of supplier satisfaction (t = 4.529). This result might appear quite surprising however on a second thought it is also not too far-fetched: Suppliers might perceive structural as a means to communicate and interact with their customer. While this seems to be a necessity in order to keep the relationship alive and carry on with common projects, simply conversing on a regular basis and exchanging information might be a good start but would also proof meaningless without certain output. As such it must not be a surprise that the existence of structural capital per se does not lead to supplier satisfaction. A similar picture appears for cognitive capital: While sharing goals and values, and even aligning them might be an important necessity for suppliers to conduct common projects with their customers and commonly work into the right direction, it does not necessarily mean that these goals will also be reached. Since supplier satisfaction naturally emerges if the supplier also sees a benefit in the exchange relationship (Huettinger et al. 2014), sharing goals and values might simply not be sufficient. Relational capital on the other hand includes trust and commitment to the relationship as well as reciprocity that the relationship will also be continued in the future (Blonska et al., 2013). For supplier, this would imply that they have a perspective of not only proceeding with the current business but also having future business opportunities with their customer. Moreover, through having a relationship based on trust and commitment, suppliers might see less risk in the relationship of e.g. opportunistic actions. This would explain the strong positive relationship between relational capital and supplier satisfaction. While structural and cognitive capital have been proven ineffective when it comes to supplier satisfaction, we still found an indirect effect that after all underlines the importance of both dimension: In line with Carey et al. (2011), our study confirms the facilitating effect of cognitive (t = 9.337) and structural capital (t = 4.168) on the development of relational capital. Both types of social capital thus should not be neglected.

Next to testing the effect of social capital as an antecedent to supplier satisfaction, we also checked for the effect of supplier satisfaction on becoming preferred customer and in turn the effect of being preferred customer on projects success with local Chinese suppliers. While, in line with Huettinger et al. (2011), the relationship between supplier satisfaction and the preferred customer status could be confirmed (t = 7.850), also the effect of preferential customership on project success was found to be positive (t = 4.256). This has a strong implication for firms that would like to engage in a business relationship with a Chinese supplier respectively are already doing business with them: While, also being to a victim to the cultural influence, doing business in China and with Chinese suppliers might not always be easy and certainly not always fruitful, firms that are able to satisfy their suppliers and become their preferred customer, increase their likelihood of finalizing common projects successfully. Obviously, this however would firstly require an investment of time into the relationship. Since our study is dealing with Chinese suppliers, the finding should also be considered carefully: Guaxi, the Chinese firm of social capital, still plays a big role in all business relationships in China. While the preferred customer measurement has been proven successful in the Chinese context, it might though be closely related to Guanxi, the exchange of favors to reach a “preferential” outcome. It could thus be hard to distinguish whether a buying firm is truly the preferred customer of a supplier or whether he simply has a high degree of Guanxi with its supplier that has developed over time. Future research could further dig into the preferred customer status in a Chinese context and focus on the interconnection with Guanxi. Also, future research should attempt to recapitulate our findings in a more global surrounding.

Appendix I – Statistics

Table 1: Fornell-Larcker Criterion

Latent variables	SC str.	SC rel.	SC cog.	Suppl. Satis	Pref. Cust.	Project Succ.	Con. aff.	Con. size	Con. comm.	Con. prox.
SC structural	**0.730**									
SC relational	0.702	**0.813**								
SC cognitive	0.680	0.808	**0.836**							
Suppl Satis.	0.548	0.713	0.634	**0.795**						
Pref. Cust.	0.448	0.534	0.464	0.580	**0.802**					
Success	0.675	0.584	0.611	0.548	0.378	**0.925**				
Con. affili.	0.121	0.097	0.024	0.016	0.046	0.071	**1.000**			
Con. size	0.229	0.130	0.188	0.084	0.080	0.115	-0.045	**1.000**		
Con. comm.	0015	-0.015	-0.046	-0.009	0.107	-0.065	-0.229	0.124	**1.000**	
Con. prox.	-0.012	-0.028	0.003	-0.011	0.056	0.010	0.074	0.061	-0.075	**1.000**

Table 2: Item Loadings

Items	*SC str.*	*SC rel.*	*SC cog.*	*Suppl. Satis.*	*Pref. Cust.*	*Project Success*	*Con affil.*	*Con. size*	*Con. prox.*	*Con. comm.*
SC_str_1	**0.743**									
SC_str_2	**0.745**									
SC_str_3	**0.704**									
SC_str_6	**0.738**									

SC_str_7	**0.771**									
SC_str_8	**0.723**									
SC_str_11	**0.739**									
SC_str_12		**0.675**								
SC_rel_1		**0.771**								
SC_rel_5		**0.859**								
SC_rel_7		**0.849**								
SC_rel_8		**0.778**								
SC_rel_9		**0.805**								
SC_cog_1			**0.857**							
SC_cog_2			**0.794**							
SC_cog_3			**0.901**							
SC_cog_5			**0.742**							
SC_cog_8			**0.877**							
Satis_1				**0.676**						
Satis_2				**0.878**						
Satis_3				**0.881**						
Satis_4				**0.724**						
PreCu2					**0.824**					
PreCu3					**0.861**					
PreCu4					**0.843**					
PreCu6					**0.664**					
Success1						**0.930**				
Success2						**0.929**				
Success3						**0.917**				
Con_Aff..							**1.000**			
Con_Size								**1.000**		
Con_Prox.									**1.000**	
Con_Comm										**1.000**

Table 3: Common method variance analysis

Items	*Construct loading (CL)*	CL^2	*Method factor loading (MFL)*	MFL^2

SC_str_1	0.854	0.729	-0.128	0.016
SC_str_2	0.757	0.573	-0.016	0.000
SC_str_3	0.565	0.319	0.150	0.023
SC_str_6	0.808	0.653	-0.065	0.004
SC_str_7	0.956	0.914	-0.202	0.041
SC_str_8	0.909	0.826	-0.197	0.039
SC_str_11	0.523	0.274	0.238	0.057
SC_str_12	0.439	0.193	0.254	0.065
SC_rel_1	0.678	0.460	0.103	0.011
SC_rel_5	0.803	0.645	0.061	0.004
SC_rel_7	0.953	0.908	-0.113	0.013
SC_rel_8	0.643	0.413	0.147	0.022
SC_rel_9	0.979	0.958	-0.190	0.036
SC_cog_1	0.968	0.937	-0.121	0.015
SC_cog_2	0.904	0.817	-0.126	0.016
SC_cog_3	0.768	0.590	0.147	0.022
SC_cog_5	0.758	0.575	-0.010	0.000
SC_cog_8	0.797	0.635	0.085	0.007
Satis_1	0.512	0.262	0.202	0.041
Satis_2	0.935	0.874	-0.069	0.005
Satis_3	0.992	0.984	-0.136	0.018
Satis_4	0.673	0.453	0.059	0.003
PreCu2	0.719	0.517	0.139	0.019
PreCu3	0.918	0.843	-0.079	0.006
PreCu4	0.797	0.635	0.072	0.005
PreCu6	0.779	0.607	-0.158	0.025
Success1	0.870	0.757	0.069	0.005
Success2	0.897	0.805	0.033	0.001
Success3	1.011	0.805	-0.103	0.011
Average	***0.799***	***0.661***	***0.0016***	***0.018***

Table 4: Construct Reliability and Validity

Latent Variable	*Cronbach's Alpha*	*rho_A*	*Composite Reliability*	*Average Variance Extracted*
SC structural	0.875	0.876	0.901	0.533
SC relational	0.871	0.874	0.907	0.661
SC cognitive	0.892	0.905	0.921	0.700
Supplier Satisfaction	0.800	0.814	0.871	0.632
Preferred Customer	0.812	0.829	0.877	0.643
Project Success	0.917	0.937	0.947	0.856
Con_Aff..	1.000	1.000	1.000	1.000
Con_Size	1.000	1.000	1.000	1.000
Con_Prox.	1.000	1.000	1.000	1.000
Con_Comm	1.000	1.000	1.000	1.000

Table 5: Path Coefficients

Path / Hypothesis	*Path coefficient*	*t-value*	*p-value*
Cognitive SC → Supplier Satisfaction (H1.1)	0.141	1.158	> 0.1, non- significant
Structural SC → Supplier Satisfaction (H1.2)	0.076	0.935	> 0.1, non- significant
Relational SC → Supplier Satisfaction (H1.3)	0.556	4.529	< 0.001, significant
Supplier Satisfaction → Preferred Customer (H2.1)	0.580	7.850	< 0.001, significant
Preferred Customer → Project Success (H2.2)	0.382	4.256	< 0.001, significant
Further significant paths			

Cognitive SC → Relational SC	0.628	9.337	< 0.001, significant
Structural SC → Relational SC	0.278	4.168	< 0.001, significant

Appendix II – Measures

Structural Capital:

	During the project, you and your customer…	
Infrastructure Actor Exchange	• Always conducted common activities / workshops. • Had common project reviews in place. • Used internal linking systems (shared fileserver etc.). • Had also purely social activities (common meals, after-work get togethers). • Made use of being located in close proximity to each other.	Own measure
Quantity of Interaction	• Frequently communicated with each other. • Frequently communicated at different levels (management, operative staff etc.). • Frequently communicated between different functions.	Villena (2011); CR: 0.87; AVE: 0.68
Nature of Communication	• Exchanged concessions throughout the project (e.g. granted more time etc.). • Solved / prevented problems commonly. • Easily found agreements jointly. • Constructively addressed topics that could entail conflicts.	Wang et al. (2013); alpha: 0.8

Cognitive Capital:

	During the project, you and your customer…	
Shared Norms & Values	• Interpreted situations in the same way / had the same approaches to business dealings. • Had a common understanding about what is allowed / not allowed. • Had the same vision of business in the relationship. • Viewed each other as partners.	Villena (2011); CR: 0.8; AVE: 0.5
Overlap of Objectives	• Were aware of each other's objectives / KPIs. • Were aligned on objectives / objectives matched. • Made the effort to align goals. • Had similar targets.	. Own measure

Relational Capital:

	During the project, you and your customer…	
Trust	• Considered own interests as well as the others. • Trusted in each other to keep the best interest in mind. • Counted on each other to follow through with promises..	Blonska (2013); CR: 0.87, AVE: 0.69
Commitment	• Found it pleasant to work with each other, which is why the relationship continued. • Wanted to remain in the relationship. • Were attracted by what the other party represented as a firm (image, brand, reference etc.).	Blonska (2013); CR: 0.86, AVE: 0.66
Reciprocity	• Considered the relationship as mutually beneficial. • Felt indebted because of what the other had done for each other. • Expected to also work on further projects in the future.	Blonska (2013); CR: 0.81; AVE: 0.69

Supplier Satisfaction, Preferred Customer and Project Success:

	From your perspective…	
Project Success	• One could be satisfied with how the project progressed. • The project goals were achieved. • The project was within schedule. • Overall, the project was done in an efficient way.	Horn et al. (2014); CR: 0.92 ; AVE: 0.6
	Concerning the project…	
Supplier Satisfaction	• Our firm was very satisfied with the overall relationship to this customer. • Generally, our firm was very pleased to have this customer as our business partner. • If we had to do it all over again, we would still choose to use this customer. • Our firm did not regret the decision to do business with this customer.	Huettinger (2014); CR: 0.94; AVE: 0.81
Preferred Customer	• We made sacrifices for our customer. • We were on our customers side. • We allocated our best resources to this customer. • We would have granted our customer prime access to our own suppliers. • We treated this customer with lower priorities than others. • In general, we offered a better service to this customer than to others.	Schiele et al. (2012); CR: 0.94 ; AVE: 0.77

Appendix III – Figures

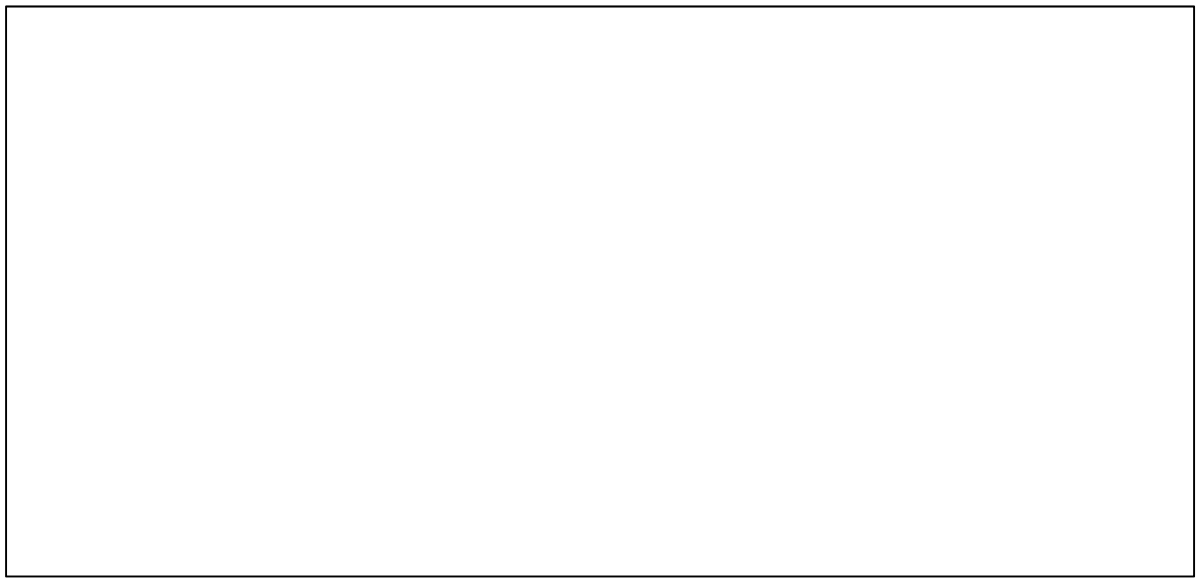
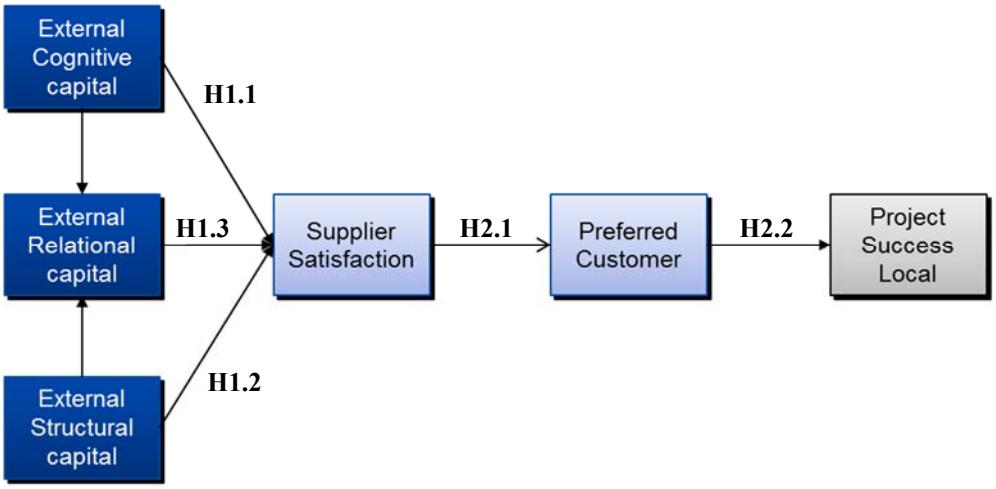


Figure 1: Research Model



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The value of flexibility for supply chain coordination under uncertainty: Quantity Flexibility Contract

Nunzia Carbonara[a], Nicola Costantino[a], Roberta Pellegrino[a*]

[a]*Dipartimento di Meccanica, Matematica e Management, Politecnico di Bari, viale Japigia 182, 70126 Bari, Italy*

* Corresponding author (r.pellegrino@poliba.it)

The purpose of this paper is to analyze the effectiveness of Quantity Flexibility Contract (QFC) as Supply Chain (SC) coordination mechanism under market demand and spot market uncertainty, by measuring such effectiveness in terms of the profits gained by each actor under QFC with respect to the profits obtained under traditional contract. In so doing and by varying the contract terms and implementation conditions, we ensure that the QFC is chosen only when it ensure a win-win condition, namely it improves the profits of both parties. A simulation-based research has been carried out in order to address this issue. In particular, a real options-based model has been developed to model and quantify the benefits granted by flexibility incorporated into the QFC, for both SC actors. A plan of experiments consisting of different experimental settings was designed in order to investigate the effect that contract terms and implementation conditions have on the benefits of both actors and on the entire system. The proposed model's application and the experiments have been illustrated by considering a SC coordination problem handled by an example company operating as retailer in a European country through QFC.

1. Introduction

The aim of supply chain management (SCM) is to coordinate material, cash and information flows along the supply chain (SC) from an End-to-End (E2E) perspective, from materials suppliers to consumers (Christopher, 1992; Tsay et al., 1999). SC control may be either centralized or decentralized (Giannocaro and Pontrandolfo, 2004). Centralized control involves the presence of a single decision-maker in possession of all the information pertaining to the SC, managing it in its entirety and thus able to optimize the performance of the whole system (channel coordination). Decentralized control involves the presence of several decision makers (SC actors), each taking decisions in pursuit of their own probably conflicting goals (Schneeweiss, 2003).

Many modern supply chains operate under decentralized control for a variety of reasons. For example, outsourcing of various aspects of production is currently a popular business model in many industries (cf. Farlow et al. 1995, Iyer and Bergen 1997), which automatically distributes decision-making authority. However, decentralization is not without risks. While centralized control ensures the system's efficiency (channel coordination), in decentralized systems, locally rational behaviours increases the uncertainties and costs in the system (cf. Magee and Boodman 1967, Lovejoy 1998), resulting in the overall inefficiency of the SC (Tang and Kouvelis, 2014; and others). Both academic researchers and practitioners have focused on trying to find coordination mechanisms that can eliminate such inefficiency by driving local actors to behave in the interests of the global SC rather than their own.

Supply chain contracts are proposed and developed to assist supply chains to achieve better coordination and performance. These include quantity flexibility (QF) contracts (Tsay et al., 1999), backup agreements (Eppen and Iyer, 1997), buy back or return policies (Emmons and Gilbert, 1998), incentive mechanisms (Lee and Whang, 1999), revenue sharing (RS) contracts (Cachon and Lariviere, 2005), allocation rules (Cachon and Lariviere, 1999), and quantity discounts (Weng, 1995).

The purpose of this paper is to analyze the effectiveness of QFc as SC coordination mechanism under market demand and spot market uncertainty, by measuring such effectiveness in terms of the profits gained by each actor under QF contract with respect to the profits obtained under traditional contracts. In so doing and by varying the contract terms and implementation conditions we ensure

that the QF is chosen only when it ensure a win-win condition, namely it improves the profits of both parties.

The paper is organized as follows. Section 2 provides a brief review of the relevant literature, while Section 3 proposes the model of QFC for coordinating a two-stage SC. Section 4 illustrates the proposed model's application by considering a SC coordination problem handled by an example company operating as retailer in a European country through QFC. Some final remarks close the paper.

2. Literature review and paper positioning

2.1 Quantity Flexibility contract

Under a QF contract the supplier formally guarantees the buyer a specific safety cushion in excess of estimated requirements, thus providing some certain flexibility on the quantity of their products. The supplier allows the buyer to change the quantity ordered after observing the actual demand. In return, the buyer agrees to limit its order reductions, essentially a form of minimum purchase agreement. In this way, the buyer could deal with different kinds of market demand risks (Tsay and Lovejoy, 1999). By reviewing the literature on QFCs it is possible to identify four standpoints that differentiate the studies: 1) the scope, 2) the SC risks mitigated by QF contract; 3) the SC performance metrics used to assess the impact of QFC; 4) the parties of which the envisaged benefits of QFC are measured. Table 1 characterizes the previous studies on QF in terms of the four main standpoints and how these are connoted by the different studies.

Table 1. Characterization of QFC studies

	Scope	**SC risks mitigated by QFC**	**Metrics to measure the impact of QFC on SC**	**Parties of which benefits of QFC are measured**
Bassok and Anupindi (1997)	Contract design: identifying the optimal order policy for any pair of total minimum quantity commitment and discounted price	market demand uncertainty	SC economic performance	buyer
Tsay and Lovejoy (1999)	Contract design: Measuring the impact of the contract flexibility parameters on SC performance: inventory, variability of order and service provided at the market interface. Contract choice: Evaluating the buyer's "willingness to pay" for positive increments of flexibility	market demand uncertainty	SC Operational performance	Parts supplier, manufacturer, retailer
Brusset (2006)	Contract design: identifying the optimal contract parameters (penalty, time horizon, quantity, price) Contract choice: Identifying the conditions - time horizon, information cost about prices and providers, penalty - for choosing QF contract over spot-market and QF contract over minimum purchase commitment	market demand uncertainty	SC economic performance	Buyer, service provider
Sethi et al. (2004)	Contract design: identifying the optimal contract quantity that maximizes the buyer's profit	market demand and supply price uncertainties	SC economic performance	retailer
Mahajan (2010)	Contract design: identifying the optimal retail price that maximizes the parties' profit	market demand uncertainty	SC economic performance	Manufacturer, retailer
Shaodong et al. (2013)	Contract design: identifying the optimal retail price for the option stock that maximizes the parties' profit	market demand uncertainty	SC economic performance	supplier, retailer
Kim (2011)	Contract choice: Identifying the conditions – demand volatility and flexibility rate - for choosing QF	market demand uncertainty	SC Operational and economic performance	Buyer, supplier

The existing literature reveals a lack of studies that analyze the effectiveness of QFC as SC coordination mechanism under both market demand and supply price uncertainties. This in turn

means measuring the benefits of the QF contract through economic metrics (profit) for every SC actor in presence of market demand uncertainty and supply price fluctuation, and prove that under the contract every actor obtains a profit higher than he/she would do without the contract.
The existing studies discuss QF contracts as SC coordination mechanisms, while they provide little emphasis on their ability to give a protection against price and demand uncertainties. The literature lacks of studies that quantitatively assess the value of on QF contract as supply chain risk mitigation strategy. Thus, we observe a gap in the literature on supply chain risk management.
This research gap offers motivation for our work that expands upon previous research in the following crucial aspects:

1) We analyze the effectiveness of QFC by measuring the profits gained by each actor under QF contract with respect to the profits obtained under traditional contracts, thus ensuring that the QFC is chosen only when it ensure a win-win condition, namely it improves the profits of both parties.
2) We investigate how the contract terms impact on the supply chain economic performance thus providing guidelines to the contract design in order to ensured that higher profits are attained for both parties (win-win situation).
3) We examine a more realistic scenario for a QFC, where both market price and customer demand uncertainty are considered. In so doing we offer a novel contribution in the literature on supply chain risk management by presenting the benefits of QFCs in mitigating demand and supply risks.

2.2 Supply contract and real option valuation literature

Let us consider a standard wholesale contract between the upstream firm (manufacturer) and its downstream retailer: once the contract is established, the firm must supply the goods at the agreed price, regardless of the market conditions at each point in time. Furthermore, once the retailer has agreed to purchase the goods, he cannot reconsider the purchase, e.g., if the demand does not materialize or the price of the alternative supply market (spot market) is more favourable. With the QFC, on the other hand, the retailer has the right (without the obligation) to deviate from an initially committed quantity. For example, the retailer wants to change his previously committed purchasing quantity of a component because additional knowledge of demand and supply market price have become available. Operationalizing a contract of this type requires modelling the managerial flexibility of the retailer to deviate from the committed quantity within a pre-defined range, without paying any penalty, in case of demand fall, and with the insurance of fixed price, in case of demand rice; and to decide to reduce the purchased quantity up to the minimum quantity and buy from the alternative source (i.e., the spot supply market) in case of favorable spot market price, whenever such choice proves convenient. Traditional approaches, such as those based on Discounted Cash Flows (DCF) analysis (especially NPV), cannot be used to model this managerial flexibility. Consequently, they cannot be used to price the value of the investigated QFC. They implicitly assume that a strategy or project will be undertaken now and operated on continuously on a set time scale, until the end of its expected useful life, even though the future is uncertain. Therefore, they are “static” and underestimate the upside value of the investment (Kogut and Kulatilaka, 1994) by assuming management’s passive and inflexible commitment to a certain “operating strategy”. They are also “deterministic”, since they make implicit assumptions concerning a certain “expected scenario” of cash flows. In the real world, the actual cash flows will probably differ from what management originally expected because of uncertainty and competitive interactions. As new information is available and uncertainty about the market conditions and future cash flows is gradually resolved, management should revise the operating strategy it originally anticipated in order to achieve the initial desired goals (Boute et al., 2004). It is essential that flexibility be quantified, and any attempt to do so almost naturally leads to the concept of options (Trigeorgis, 1996). From this perspective, the QFC,

which provides the retailers with the flexibility to update its choices as the uncertainties of the market demand and supply price resolve where it is actually convenient, adopts an option mechanism.

This paper is closely related to the literature on the use of options in SCM (; Wang and Tsao, 2006; Cheng et al., 2003; Cachon and Lariviere, 2001; Wang and Liu, 2007; Costantino and Pellegrino, 2010; Carbonara et al., 2017). We are unaware of any research that specifically models QFC as an option contract, thus addressing the benefits for the supply chain when, under a QFC, retailers have the possibility, but not the obligation, to deviate from an initially committed quantity.

The above discussion offers a strong incentive for us to model the QFC as an option contract in the coordination of a two-stage SC faced with stochastic customer demand and supply price, including the flexibility of the retailer to deviate from the initially committed quantity, whenever it is actually convenient. This will allow a correct analysis of the general conditions under which the QFC is beneficial, i.e., able to bring about supply chain coordination and a win-win situation, as well as an understanding of the impact of contract terms.

Regarding option pricing, the methods traditionally proposed in the literature on real options are financially-based approaches to option pricing (Black and Scholes 1973; Merton, 1973; Boyle, 1977; Cox et. al., 1979; Longstaff and Schwartz, 2001; and others). However, they often turn out not to be workable in practice (de Neufville et al., 2006; Lander and Pinches, 1998).

Simulation-based research is preferred for complex and expanded problems with several factors and interactions, as it is in supply chain settings (Goldsby et al., 2006; Wan and Evers, 2011; Evers and Wan, 2012; Manuj and Mentzer, 2009; Manuj et al., 2014).

3. The ROV simulation model for QFC

In this section we consider a two-stage supply chain, where each node represents an independently managed organization. The first stage consists two nodes: a *manufacturer* that holds a relationship with a *retailer* through a QF contract, and the *spot market* which represents the alternative supply market for the retailer. The second stage consists of only one node, namely the *retailer*, serving an uncertain market demand. The analysis may be easily extended to more complex supply chains without undermining the foundation principles of the model.

We consider a multi-period problem where the retailer first plans procurement of products from the manufacturer for the next period based on the current demand forecast and then makes the actual purchases based on the updated information of the uncertain demand and the fluctuating price of the spot market.

3.1 Mathematical formulation

Let Q* be the fixed periodical quantity ordered by the retailer, at each order time t, up to the contract duration T. Contrarily to the traditional contract, the QFC allows the retailer to make the actual purchase, at each t, according to the updated information on the actual demand and spot market price. In each period t, the retailer can adjust the order quantity by increasing - up to a maximum quantity $Q^*(1+\alpha)$ - or decreasing - up to a minimum quantity $Q^*(1-\beta)$ - the purchased quantity without paying any penalty. For all the purchased quantities ranging in such interval, the retailer has to pay a price C_f to the manufacturer engaged in such QFC. The manufacturer is not the only source for the retailer, which may still decide to buy the needed quantity from the spot supply market at a price C_m. The flexibility provided by the QFC consists operatively in the right of the retailer to deviate from the committed quantity within the pre-defined range $[\, Q^*(1-\beta); Q^*(1+\alpha)]$, without paying any penalty, in case of demand fall, and with the guarantee of buying at a fixed price, in case of demand rice; and to decide to reduce the purchased quantity up to the minimum quantity $Q^*(1-\beta)$ and buy from the alternative source (i.e., the spot supply market) in case of favorable spot market price, whenever such choice proves convenient.

In terms of real options, this corresponds to a real (put) option hold by the retailer, where the saving obtained when the retailer does not buy from the manufacturer is the exercise price of the option. Hence, this put option will be exercised whether the price paid to buy from the spot supply market (i.e., the underlying asset of the option S_T) is lower that the exercise price.

The sunk cost of the flexibility, namely the transaction costs for implementing the contract, the higher costs for maintaining the contract, etc., is the cost of the option (option premium).
In order to operationalize and quantify the differential profits gained by the manufacturer and the retailer under the QFC compared to the traditional contract, the model adopts the following parameters:

t = 1, …, T	order time (week, month, quarter, according to the order characteristics), up to the total time horizon T, which depends on the length of the QFC
Q^*	the fixed periodical quantity ordered by the retailer, at each order time t, which can be revised when the retailer makes the actual purchase
α and β	flexibility parameters which determine the range within which the quantity purchased can vary with respect to the ordered quantity
P_v	final price of the product sold by the *retailer* to the final customer
C_f	fixed price paid by the retailer to the manufacturer for each unit purchased within the flexibility range $[Q^*(1-\beta); Q^*(1+\alpha)]$
C_T	price paid by the retailer to the manufacturer for each unit purchased under the traditional contract, which is generally the average actual price changed by the market when the contract is stipulated.
P_{pm}	penalty due to the manufacturer for each unit of product the retailer purchases less than the committed quantity Q^*, under the traditional contract. It also corresponds to the penalty paid to the manufacturer for each unit the retailer purchases less than the minimum quantity $Q^*(1-\beta)$ under the QFC.
C_p	the unit variable manufacturing cost of the manufacturer, under the traditional contract and the QFC. It includes: materials, energy and other variable costs.
C_c	fixed costs of the manufacturer, computed for the period related to the order time (week, month, quarter, according to the order characteristics). It is function of the production capacity and includes the investment costs in tangible (building, equipment, etc.) and intangible (patents, know-how, etc.) assets. Since the QFC requires a greater production capacity to deal with the flexibility of the supply contract than the traditional one, it generally results that $C_c^{TC} < C_c^{QFC}$.
D(t)	market demand at each t
δ_m	actual share of the demand supplied by the spot supply market when the retailer decides to purchase from this alternative source.
$C_m(t)$	market price that the retailer pays at each t when he/she buys from the spot supply market
$C_{st}(t)$	stockout costs due to the inability of the retailer to fulfil the customer requirement. For example, with no inventory of a certain item, a customer order will not be fulfilled.
i_t	periodical discount rate (calculated from the annual discount rate i)

We also made the following assumption:
- The availability of the spot market δ_m to provide the required quantity decreases when the market demand D(t) increases, according to an exponential probability distribution $f\big(D(t)\big) = \lambda e^{-\lambda \cdot D(t)}$, where λ measures the gradient of the function. We assume that an increase of the market demand may be considered a signal of growth of the entire sector's demand, this in turn will increase the total demand on the supply market. Hence, in the short period (as it is between two order time t, t+1), when it is not possible to increase the productivity capacity, the availability of the spot supply market to fulfil such a growing demand decreases.
- the stockout costs include all the costs charged by the retailer when she/he is unable to fulfil the customer order, such as lost sales, penalty, loss of customers, loss of image, etc. Although they are important costs in SCM practice, they are often neglected for their difficult objective estimation (Wu et al., 2008).

To investigate the effectiveness of the QFC to coordinate the two-stage supply chain (SC) in presence of uncertain market demand and spot market price, four basic scenarios may be identified:

- Scenario 1: the market demand is higher than the maximum quantity $Q^*(1+\alpha)$ that the retailer can order at fixed price under QFC.
- Scenario 2: the market demand ranges between Q* and the maximum quantity $Q^*(1+\alpha)$.

- Scenario 3: the market demand is between Q* and the minimum quantity $Q^*(1-\beta)$.
- Scenario 4: the market demand is lower than the minimum quantity $Q^*(1-\beta)$.

To quantify the differential profits of both actors, manufacturer and retailer, under the QFC compared to the traditional contract, we consider only Scenarios 2 and 3, since the other two Scenarios have the same characteristics of the traditional contract, without any differential profits provided by QFC. To put it differently, only in the Scenario 2 and 3 the QFC provides different profits for the two SC actors compared to the traditional contract, since it provides to the retailer the flexibility to revise the order quantity Q* and make the actual purchase, at each t, according to the updated information on the actual demand and the spot market price.

Also, we consider Scenario 2 and 3 separately since in the traditional contract the retailer's behavior in these two scenarios is different. In the first (Scenario 2) ($Q^* < D(t) < Q^*(1+\alpha)$), the retailer will purchase the quantity exceeding Q* from the spot supply market without any insurance of availability. Contrarily, in the latter (Scenario3) ($Q^*(1-\beta) < D(t) < Q^*$), the retailer has to pay a penalty for the shortfall.

In the following, the profits of the QFC compared with the traditional contract are modeled, for the manufacturer and the retailer, in both scenarios.

Scenario 2 - $\left(Q^* < D(t) < Q^*(1+\alpha)\right)$

In traditional contract the retailer will purchase the additional quantity $(D(t)-Q^*)\delta_m$ from the spot supply market at $C_m(t)$, based on the market availability, and will bear the stockout costs $C_{st}(t)$ for the residual quantity which is not delivered to the customer $(D(t)-Q^*)(1-\delta_m)$.

The retailer's profit in the traditional contract Π_R^{TC}, Scenario 2, is computed at each t by equation (1).

$$\Pi_R^{TC} = P_v Q^* + P_v(D(t)-Q^*)\delta_m - [C_T Q^* + C_m(t)(D(t)-Q^*)\delta_m + C_{st}(t)(D(t)-Q^*)(1-\delta_m)] \quad (1)$$

In QFC, the retailer may receive all the needed quantity (up to $Q^*(1+\alpha)$) from the manufacturer at C_f; he also has the possibility to reduce the quantity purchased under QFC up to $Q^*(1-\beta)$ and buy from the spot market at $C_m(t)$, whenever it is available and convenient.

In terms of real options, the retailer will decide to exercise the option if the saving when he does not buy from QFC (namely, the exercise price of the option, $C_f[D(t)-Q^*(1-\beta)]\delta_m$) is higher than the cost paid to purchase that quantity from the spot supply market (namely, the stock price of the option, $C_m(t)[D(t)-Q^*(1-\beta)]\delta_m$).

The retailer's decision to exercise the option will depend on the expected payoff of the option computed as in (2).

$$Option\ payoff = max\{C_f[D(t)-Q^*(1-\beta)]\delta_m - C_m(t)[D(t)-Q^*(1-\beta)]\delta_m; 0\} \quad (2)$$

Hence, according to (2), the retailer will decide whether to exercise the option ($O_{QFC} = 1$) and buy the quantity $[D(t)-Q^*(1-\beta)]\delta_m$ from the spot market at $C_m(t)$, and the remaining quantity $[D(t)-Q^*(1-\beta)](1-\delta_m)$ at C_f from the manufacturer under the QFC.

The retailer's differential profit gained under QFC compared to traditional contract at each t, $\Pi_R^{(QFC-TC)}(t)$, in Scenario 2, is computed by (3) or (4), depending on the exercise of the option ($O_{QFC} = 1$) or not ($O_{QFC} = 0$) respectively.

$$\Pi_R^{(QFC-TC)}(t) = \begin{cases} P_v[D(t)-Q^*(1-\beta)] - C_m(t)[D(t)-Q^*(1-\beta)]\delta_m - C_f[D(t)-Q^*(1-\beta)](1-\delta_m) + \\ \quad -\{P_v Q^*\beta + (P_v - C_m(t))[D(t)-Q^*]\delta_m - C_{st}(t)[D(t)-Q^*](1-\delta_m) - C_T Q^*\beta\} \end{cases} \quad if\ \ O_{QFC}=1 \quad (3)$$

$$\Pi_R^{(QFC-TC)}(t) = \begin{cases} P_v[D(t)-Q^*(1-\beta)] - C_f[D(t)-Q^*(1-\beta)] - \\ +\{P_v Q^*\beta + (P_v - C_m(t))[D(t)-Q^*]\delta_m - C_{st}(t)[D(t)-Q^*](1-\delta_m) - C_T Q^*\beta\} \end{cases} \quad if\ \ O_{QFC}=0 \quad (4)$$

The retailer's differential profit gained under QFC compared to traditional contract over the total time horizon T, which depends on the length of the QFC, is computed as the sum of the discounted profits gained at each t (with t = 1, …, T), as in (5).

$$\Pi_R^{(QFC-TC)} = \sum_{t=1}^{T} \frac{\Pi_R^{QFC}(t)}{(1+i_t)^t} \quad (5)$$

The manufacturer's profit in the traditional contract Π_M^{TC} at each t is computed by equation (6):

$$\Pi_M^{TC}(t) = C_T Q^* - C_p Q^* - C_c^{TC} \quad (6)$$

Where C_c^{TC} are the fixed costs borne by the manufacturer computed for the period related to the order time t.

The differential profit that the manufacturer gains under QFC compared to the traditional contract is affected by the retailer's decision to exercise the option and the availability of the spot market to provide the required quantity. When the retailer exercises the option, the manufacturer's differential profit decreases since the quantity sold to the retailer decreases to $(1-\delta_m)[D(t) - Q^*(1-\beta)]$. When the retailer does not exercise the option, the manufacturer gains a higher profit which is the difference between its revenues $\left(C_f[D(t) - Q^*(1-\beta)]\right)$ and its production costs $\left(C_p[D(t) - Q^*(1-\beta)] + C_c^{QFC}\right)$.

The differential profit of the manufacturer in Scenario 2 under QFC compared to the traditional contract $\Pi_M^{QFC}(t)$ is computed, at each t, by (7) or (8), depending on the exercise of the option by the retailer ($O_{QFC} = 1$) or not ($O_{QFC} = 0$) respectively.

$$\Pi_M^{(QFC-TC)}(t) = C_f[D(t) - Q^*(1-\beta)](1-\delta_m) - C_p[D(t) - Q^*(1-\beta)](1-\delta_m) - C_c^{QFC} - \left[(C_T - C_p)Q^*\beta - C_c^{TC}\right] \quad if \quad O_{QFC} = 1 \quad (7)$$

$$\Pi_M^{(QFC-TC)}(t) = (C_f - C_p)[D(t) - Q^*(1-\beta)] - C_c^{QFC} - \left[(C_T - C_p)Q^*\beta - C_c^{TC}\right] \quad if \quad O_{QFC} = 0 \quad (8)$$

The manufacturer's differential profit gained under QFC compared to traditional contract over the total time horizon T, which depends on the length of the QFC, is computed as the sum of the discounted profits gained at each t (with t = 1, …, T), as in (9).

$$\Pi_M^{(QFC-TC)} = \sum_{t=1}^{T} \frac{\Pi_M^{(QFC-TC)}(t)}{(1+i_t)^t} \quad (9)$$

Scenario 3 - $(Q^*(1-\beta) < D(t) < Q^*)$

In traditional contract the retailer will not have the flexibility of purchasing less than the committed quantity Q^*. In such case, in fact, the retailer has to pay the (unitary) penalty P_{pm} to the manufacturer for the shortfall. The retailer's profit in the traditional contract Π_R^{TC} in Scenario 3 is computed at each t as in (10).

$$\Pi_R^{TC}(t) = P_v D(t) - \left[C_T D(t) + P_{pm}(Q^* - D(t))\right] \quad (10)$$

Contrarily to traditional contract, in QFC the retailer may revise the purchased quantity without paying any penalty: he/she has the possibility to reduce the quantity purchased under QFC up to $Q^*(1-\beta)$ and buy from the spot market at $C_m(t)$, whenever it is available and convenient.

In terms of real options, the retailer will decide to exercise the option if the saving gained by not buying from the manufacturer under QFC (namely, the exercise price of the option, $C_f[D(t) - Q^*(1-\beta)]\delta_m$) is higher than the cost paid to purchase that quantity from the spot supply market (namely, the stock price of the option, $C_m(t)[D(t) - Q^*(1-\beta)]\delta_m$).

The retailer's decision to exercise the option will depend on the expected payoff of the option computed as in (11).

$$Option\ payoff = max\{C_f[D(t) - Q^*(1-\beta)]\delta_m - C_m(t)[D(t) - Q^*(1-\beta)]\delta_m; 0\} \quad (11)$$

Hence, according to (11), the retailer will decide whether to exercise the option ($O_{QFC} = 1$) and buy the quantity $[D(t) - Q^*(1-\beta)]\delta_m$ from the spot market at $C_m(t)$, and the remaining quantity $[D(t) - Q^*(1-\beta)](1-\delta_m)$ at C_f from the manufacturer under the QFC.

The retailer's differential profit gained under QFC compared to traditional contract $\Pi_R^{(QFC-TC)}(t)$, in Scenario 3, is computed at each t by (12) or (13), depending on the exercise of the option ($O_{QFC} = 1$) or not ($O_{QFC} = 0$) respectively.

$$\Pi_R^{(QFC-TC)}(t) = -C_m(t)[D(t) - Q^*(1-\beta)]\delta_m - C_f[D(t) - Q^*(1-\beta)](1-\delta_m) - \left\{-C_T[D(t) - Q^*(1-\beta)] - P_{pm}[Q^* - D(t)]\right\} \quad if \quad O_{QFC} = 1 \quad (12)$$

$$\Pi_R^{(QFC-TC)}(t) = -C_f[D(t) - Q^*(1-\beta)] - \{-C_T[D(t) - Q^*(1-\beta)] - P_{pm}[Q^* - D(t)]\} \quad if \quad O_{QFC} = 0 \quad (13)$$

The retailer's differential profit gained under QFC compared to traditional contract over the total time horizon T, which depends on the length of the QFC, is computed as the sum of the discounted profits gained at each t (with t = 1, …, T), as in (14).

$$\Pi_R^{(QFC-TC)} = \sum_{t=1}^{T} \frac{\Pi_R^{(QFC-TC)}(t)}{(1+i_t)^t} \quad (14)$$

The manufacturer's profit in the traditional contract Π_M^{TC} is computed, for the Scenario 3, by equation (15).

$$\Pi_M^{TC}(t) = C_T\big(D(t) - Q^*(1-\beta)\big) + P_{pm}\big(Q^* - D(t)\big) \quad (15)$$

The differential profit that the manufacturer gains under QFC compared to the traditional contract, in Scenario 3, is affected by the retailer's decision to exercise the option and the availability of the spot market to provide the required quantity. When the retailer exercises the option, the manufacturer's differential profit decreases since the quantity sold to the retailer decreases to $(1-\delta_m)[D(t) - Q^*(1-\beta)]$. When the retailer does not exercise the option, the manufacturer gains a higher differential profit which is the difference between its revenues $\big(C_f[D(t) - Q^*(1-\beta)]\big)$ and its production costs $\big(C_p[D(t) - Q^*(1-\beta)] + C_c^{QFC}\big)$.

The differential profit of the manufacturer in scenario 3 under QFC compared to the traditional contract $\Pi_M^{(QFC-TC)}(t)$ is computed, at each t, by (16) or (17), depending on the exercise of the option by the retailer ($O_{QFC} = 1$) or not ($O_{QFC} = 0$) respectively.

$$\Pi_M^{(QFC-TC)}(t) = C_f[D(t) - Q^*(1-\beta)](1-\delta_m) - C_p[D(t) - Q^*(1-\beta)](1-\delta_m) - C_c^{QFC} - \big[(C_T - C_p)[D(t) - Q^*(1-\beta)] + P_{pm}\big(Q^* - D(t)\big) - C_c^{TC}\big] \quad if \quad O_{QFC} = 1 \quad (16)$$

$$\Pi_M^{(QFC-TC)}(t) = C_f[D(t) - Q^*(1-\beta)] - C_c^{QFC} - \big[C_T[D(t) - Q^*(1-\beta)] + P_{pm}\big(Q^* - D(t)\big) - C_c^{TC}\big] \quad if \quad O_{QFC} = 0 \quad (17)$$

The manufacture's differential profit gained under QFC compared to traditional contract over the total time horizon T, which depends on the length of the QFC, in Scenario 3, is computed as the sum of the discounted profits gained at each t (with t = 1, …, T), as in (18).

$$\Pi_M^{(QFC-TC)} = \sum_{t=1}^{T} \frac{\Pi_M^{(QFC-TC)}(t)}{(1+i_t)^t} \quad (18)$$

4. Experiments and analysis

4.1. The base-line model

The proposed model's application has been illustrated by considering a SC coordination problem handled through QFC from an example company that is effectively similar to the real-world business unit of a company operating as retailer in a European country where one of the authors was involved in supply chain management for several years.

A time period T of 12 months with a time bucket of 1 month was considered for the analysis, while the discount rate was not considered since the time horizon was one year.

Table 2 summarized the characteristics of the QFC.

Table 2. Characteristics of QFC

T	12 months
Q^*	50 units
α	0.6
β	0.6
C_f	55 €/unit

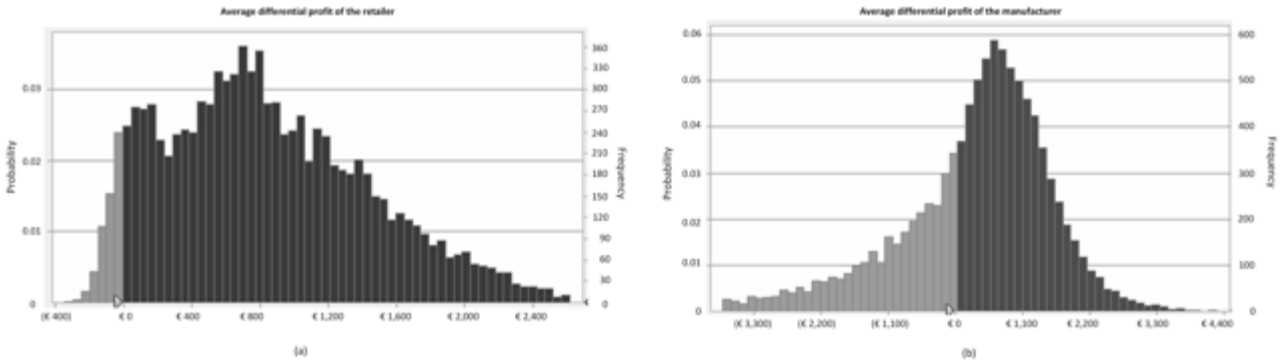
All the input data are reported in Table 3.

Table 3. Values of the input parameter of the base-line model

D_0	50 units
μ_D	0.80%
σ_Q	40%
Cm	Normal (μ=48 €/unit; σ= 1.44)
Pv	87 €/unit
Cst	Betapert(Optimistic = 34, Most likely = 35, Pessimistic = 36)
λ	0.06
CT	50 €/unit
Cf	55 €/unit
Ppm	4 €/unit
Cp	30 €/unit
C_c^{TC}	39 €
C_c^{QFC}	42 €
i	0.036

The simulation model is developed by using the @Crystal ball software. The Monte Carlo simulation approach was used for calculating the value of each strategy (10,000 computer runs).
Figure 1 shows the simulation results for the base-line model, namely the probability distributions of the differential profits of the retailer (Figure 1a) and manufacturer (Figure 1b) gained under QFC compared to traditional contract during the considered time period.

Figure 1. Simulation results for the base-line model



As shown by Figure 1a, the differential profit the retailer gains under QFC compared to traditional contract during the considered time period is positive with a probability of 0.94 (risk of loss 0.06), and shows an average value of about € 852. This means that in 94 cases out of 100 the QFC is more convenient than the traditional contract for the retailer. Besides looking at the probability of being positive, it is important to analyze the absolute value of the retailer's differential profit created by the QFC. It ranges between -€343 and €4,338. This suggests that although there can be cases where the QFC produces a loss compared to the traditional contract, the impact of such loss on the organization is low compared to the potential opportunity of creating profit (upper extreme of the distribution is much higher than the lower extreme: €4,338). Figure 1b shows that the QFC creates value also for the manufacturer, although with a lower probability of being positive, which is 0.67 (risk of loss 0.33). This means that the QFC is worthy for the manufacturer in 67 out 100 cases. This is due to the higher price charged by the manufacturer under QFC compared to traditional contract, in return for the flexibility for the retailer to revise the contract. For the manufacturer's differential profit, the range of variability is much higher than the one found for the retailer, since it ranges between -

€10.637 and €4,775. In this case, we find that the impact of loss is more significant for the manufacturer than for the retailer. The findings demonstrate the effectiveness of the QFC as a SC coordination mechanism under market demand and supply price uncertainty. This outcome confirms what qualitatively and empirically found by the existing literature about the effectiveness of QFC as SC coordination mechanism under market demand and extends it by quantitatively showing that QFC is an effective SC coordination mechanism under supply price uncertainty. We also find that the QFC adoption as SC coordination mechanism is not riskless since there is chance that it increases the costs in the system, resulting in the overall inefficiency of the SC and that the loss distribution between the two actors is unbalanced. As a consequent implication, beyond the specific values associated to the considered case, our study demonstrates the importance of properly assessing the value created by QFC compared to traditional contract.
All the simulation results were reviewed through a structured walk-through with a set of managers of both firms, which considered them as reasonable.

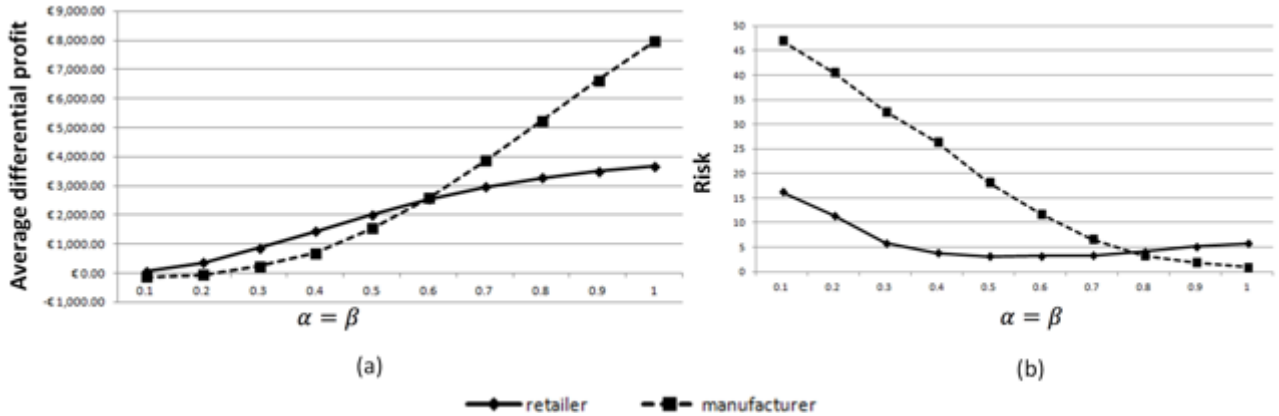
4.2. Simulation analysis

Once the base-line model was tested, we carried out a simulation analysis to investigate the effect that contract terms and implementation conditions have on the differential profits of both actors and on the entire system.
We designed a plan of experiments consisting of four experimental settings (in total 30 scenarios), which are briefly described in the following:

- The first experimental setting aims at investigating the effect of the flexibility parameters α and β (which determine the range within which the quantity purchased can vary with respect to the ordered quantity) on the differential profits of both actors and on the entire system. Operatively, we vary their value in the range [0.1, 1], by assigning them the same value ($\alpha = \beta$).
- The second experimental setting aims at investigating the effect of the availability of the spot supply market δ_m to provide the quantity required by the retailer on the differential profits of both actors and on the entire system. We vary λ in the range [0.02; 0.09].
- The third experimental setting is aimed at investigating the effect of the contract duration T on the differential profits of both actors and on the entire system, by varying T within the range [12; 48].
- The fourth experimental setting is aimed at investigating the effect of price paid by the retailer to the manufacturer under QFC on the differential profits of both actors and on the entire system. Operatively, we change the value of the parameter C_f (in the range [53; 60]). Such analysis allows us to study how the higher bargaining power of one actor over the other influences the differential profits of both actors. The assumption is that if the manufacturer has a high bargaining power over the retailer, he will force the retailer to pay for his products a higher price than the average one applied by the market (Cf >> Cm). On the contrary, if the manufacturer has a low contractual power, the retailer's purchase price will be slightly higher than the current spot market price.

The simulation results achieved by 10,000 runs for each experimental setting and the related managerial implications are discussed above.
The results of the first experimental setting (i.e., analysis of the effect of flexibility parameters change) are shown in Figure 2.

Figure 2. Results of the first experimental setting: effect of α and β on average differential profits and risk.

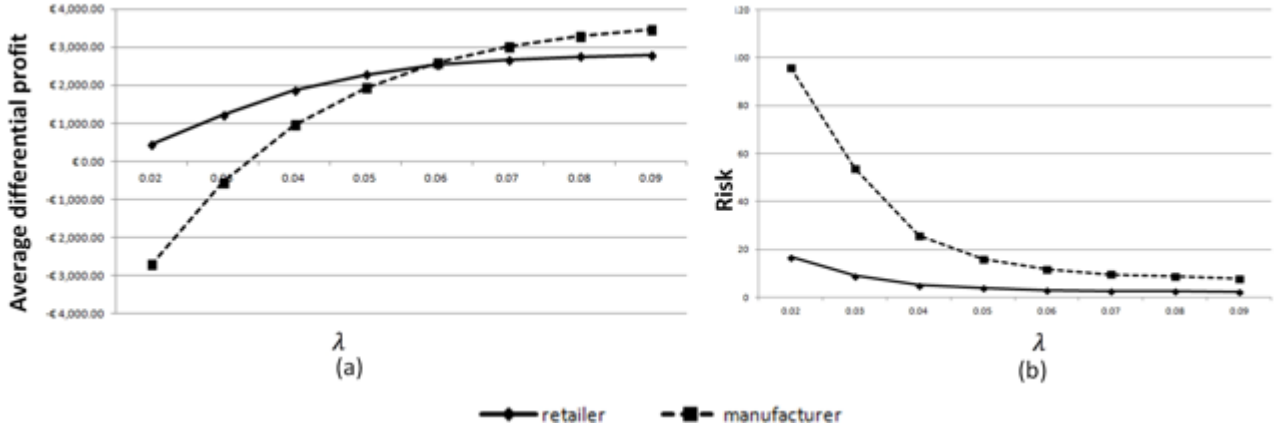


The figure 2a plots the manufacturer's and the retailer's differential profits gained under QFC compared to traditional contract over the total time horizon T for different values of the flexibility parameters α and β. Results show that when α and β increase, the manufacturer's differential profit is averagely higher than the retailer's one. In particular, when $\alpha = \beta = 0.6$, the average profits of the two actors are almost equal (around € 2,570). For values of α and β higher than 0.6, the differential profits increase for both actors, much more for the manufacturer than for the retailer; while for α and β lower than 0.6, the profits are lower but they are slightly higher for the retailer than for the manufacturer. As for the risk borne by the two parties (Figure 2b), the trend is opposite: the risk decreases when the flexibility parameters α and β increase. In particular, it is interesting to observe that the risk of the manufacturer is much more higher than the one of the retailer for low values of α and β, while the risk borne by the manufacturer and the retailer becomes equal for $\alpha = \beta = 0.8$.

This finding has two main implications. Firstly, while it seems that for flexibility parameters higher than 0.3 the QFC averagely provides higher profits for both actors compared to a traditional contract, it is very risky for the manufacturer to engage in such contract for values of α and β lower than 0.6-0.7. This supports the importance of quantifying the benefits associated with such contracts, and setting the contract parameters in order to ensure a win-win condition for both chain partners. Secondly, the profits of both actors increase when the flexibility granted by such contracts increases too, hence, confirming quantitatively the power of flexibility to coordinate supply chain.

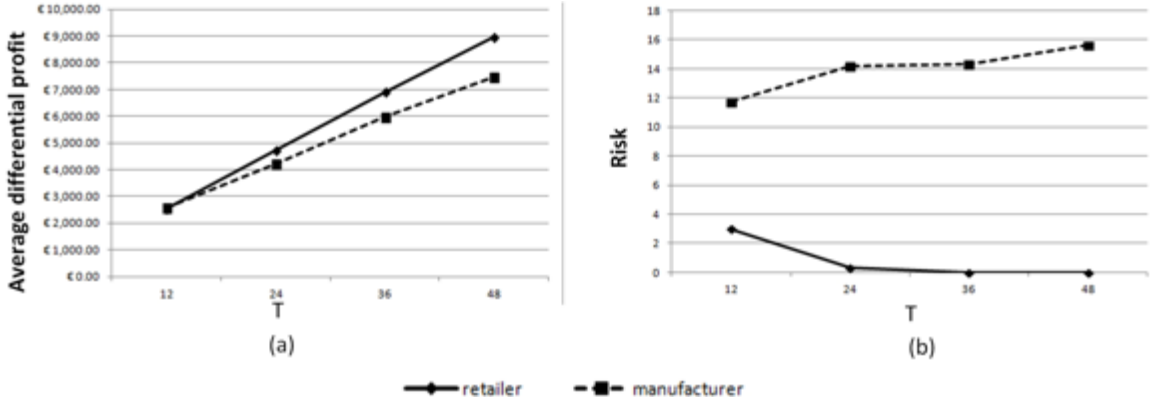
The results of the second experimental setting (i.e., analysis of the effect of the availability of the spot supply market to provide the quantity required by the retailer), shown in Figure 3, reveal that the QFC is more effective in coordinating the SC and creating win-win condition when the spot market is less available to supply the required quantity (i.e., higher value of λ). In fact, the retailer may obtain higher profits since he has the needed quantity that he would not obtain under the traditional contract due to the unavailability of the market, thus avoiding stock out costs, while the manufacturer may sell at higher price than the one that would have charged under the traditional contract.

Figure 3. Results of the second experimental setting: effect of λ on average differential profits and risk



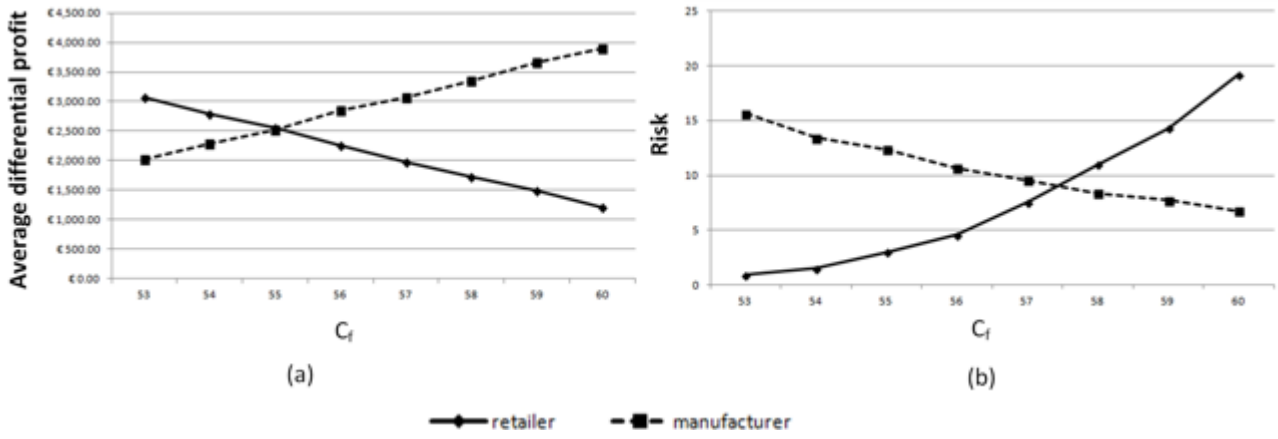
Also the risk bone by the two parties decreases when λ increases (Figure 3b): lower the availability of the spot market to provide the needed quantity, higher the probability of exploiting the contract and providing benefits to the chain partners. By inspection in Figure 3a and 3b, we can observe however that the QFC does not prove valuable in all the circumstances for both actors. In particular, when the availability of the spot market to fulfil the needed quantity increases, the retailer will exploit less the QFC since he will purchase from the spot market. Hence, the manufacturer reduces potentially its sales and revenues, hence its profit. The main managerial implication is that the QFC does not seem to be valuable in all the markets and contexts; it ceases to coordinate effectively the SC when the spot supply markets is widely available to fulfill the retailer requirements.
The results of the third experimental setting show that the profits of both actors increase linearly with the duration of the contract, keeping the same unbalanced risk distribution between the two actors. The main managerial implication is that the QFC increases its effectiveness as SC coordination mechanism when the buyer-supplier relationships become longer.

Figure 4. Results of the third experimental setting: effect of T on average differential profits and risk



Finally, the results of the fourth experimental setting show that a higher bargaining power of one actor over the other produces a resulting situation which is unbalanced towards the actor with high contractual power, either in terms of benefits or in terms of probability of loss (Figure 5).

Figure 5. Results of the fourth experimental setting: effect of C_f on average differential profits and risk



5. Conclusions

A simulation-based research has been carried out in order to analyze the effectiveness of QFC as SC coordination mechanism under market demand and spot market uncertainty, by measuring such effectiveness in terms of the profits gained by each actor under QF contract with respect to the profits obtained under traditional contracts. In so doing and by varying the contract terms and

implementation conditions we ensure that the QF is chosen only when it ensure a win-win condition, namely it improves the profits of both parties.

The experiments show the effect that contract terms and implementation conditions have on the benefits of both actors and on the entire system thus providing guidelines to the contract design in order to ensure that higher profits are attained for both parties (win-win situation).

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Efficiency and Effectiveness of Knowledge Management Systems in Supply Firms

Abstract

This paper proposes a 3D fuzzy logic methodology to assess the efficiency and effectiveness of knowledge management systems (KMSs) adopted by suppliers and identifies a taxonomy bringing together the behaviour of suppliers when adopting KMSs. The proposed methodology was previously tested on an individual supplier and then implemented on a sample of 61 suppliers. The results highlight that there is an ample variety of behaviours related to the nature of knowledge and the KMSs used. Specifically, four typologies of behaviour are identified: the efficient and effective supplier, the inefficient supplier, the ineffective supplier, and the inefficient and ineffective supplier. The results show that only 18% of surveyed suppliers are efficient and effective for both KM-Tools and KM-Practices, the remaining 82% are inefficient or ineffective for KM-Tools and/or KM-Practices. Lastly, the paper shows how this methodology may be used by a supplier as a managerial tool to suggest appropriate changes in order to improve the efficient and effective use of KMSs supporting supply firms in the knowledge management process.

Keywords - Efficiency and effectiveness, IT-based systems, knowledge management system (KMS), organization practices, supplier

1. Introduction

A vast literature underlines that knowledge management (KM) has becoming increasingly crucial for a supplier's competitiveness. The growing interest of scholars and practitioners is proved by the positive trend for papers dealing with the topic of knowledge management. In fact, consulting the Scopus database, it emerges that between 1971 and 1985 there were only 32 papers on the topic of knowledge management, but between 1986 and 2000 the number of papers increased to 1,302 (a 3,969% rise compared with 1971-1985), and in the period 2001-2016 the number of papers reached 56,463 (with a growth ratio of about 4,237% with respect to 1986-2000).
Despite this an increasing literature analysing how knowledge management is becoming a key strategic factor in the new industrial environment (Hong et al., 2014), in the field of supply chain management the role of knowledge management seems still neglected. Whereas exists a consistent amount of research concerning knowledge management in large customer companies, the literature has devoted little attention to supply firms. In particular, while the literature proposes a variety of contributions underlining the critical success factors affecting KM (Desouza et al., 2003, Blome et al., 2014; Chang et al., 2012; Cheng and Fu, 2013; He et al., 2013; Kim et al., 2012; Loke et al., 2012; Mak and Ramaprasad, 2003; Zhang and Zhou, 2013), and the impact of KM on performance (Abid and Ali, 2014; Fugate et al., 2012; Gholami et al., 2013; Halley et al., 2010; Hult et al., 2004, 2006; Liu et al., 2012; Lu et al., 2014; Sambasivan et al., 2009), there is little empirical research on knowledge management systems (KMSs) used by suppliers to support knowledge management process. The few papers that deal with the topic of KMSs in supply chain do not offer a clear framework about the KMSs used. Moreover, the issue of the

efficiency and the effectiveness of knowledge management systems (KMSs) according to the nature of a firm's knowledge still appears to be largely neglected (Cerchione and Esposito, 2016). Nevertheless, this issue is extremely relevant for four main aspects (Bhatt, 2001; Holsapple, 2005). Firstly, the use of efficient and effective KMSs leads to a correct alignment between the nature of the supplier's knowledge and the KMSs used, which is itself a factor that could positively affect the KM process (and could conversely be a barrier to the KM process). Secondly, inefficiency means a misalignment between the nature of knowledge and KMSs that may generate problems relating to the underutilization of KMSs, which could in turn have a negative impact on a supplier's performance. Thirdly, any inefficiency and ineffectiveness will, in turn, affect the entire supply chain (Esposito and Passaro, 2009, Liu et al., 2014; Nagati and Rebolledo, 2013). Fourthly, over the last few years, information and communications technologies (ICTs) have changed the nature of KMSs, offering customers and suppliers new low-cost, easy to use knowledge management tools (Antonelli, et al., 2000; Garrigos-Simon et al., 2012; Matlay and Westhead, 2005).

In this context, this paper aims to address the issue of the efficiency and effectiveness of knowledge management systems in relation to the nature of a supplier's knowledge. Specifically, the paper proposes a fuzzy-logic based methodology to evaluate the level of efficiency and effectiveness of KMSs used by suppliers. The methodology is implemented by means of a survey involving 61 Italian suppliers operating in high-tech industries and/or complex industries.

The remainder of the paper is structured as follows. After this introduction, the methodology is set out in the second section. The third section illustrates the field analysis and the context of the investigation. The fourth section is dedicated to the implementation of the methodology and the discussion of the results obtained from the suppliers surveyed. Lastly, the conclusions and implications are discussed in the fifth section.

2. Methodology

A fuzzy logic-based methodology is proposed to evaluate the efficiency and effectiveness of knowledge management systems in relation to a supplier's knowledge. The proposed methodology is divided into three phases. The first phase consists in mapping supplier's knowledge according to the two perspectives of analysis proposed by Nonaka in 1994. The second phase consists in mapping the KMSs used by suppliers by means of a Delphi panel involving two senior IT consultants and two researchers. Finally, the indices of efficiency and effectiveness are defined in the third phase.

2.1 Mapping a supplier's knowledge

In accordance with Nonaka (1994), two knowledge dimensions have to be taken into consideration in order to map a supplier's knowledge: the degree of formalization (epistemological dimension) and the degree of sharing (ontological dimension).

The epistemological dimension regards the nature of knowledge. It ranges from tacit to explicit knowledge (Polanyi, 1966). Tacit knowledge is knowledge embedded in a human mind and entails a body of beliefs, perceptions, perspectives, and values. It is difficult to access without ongoing engagement with the knowledge holder. Explicit knowledge is articulated, codified, and communicated in symbolic form and/or natural language. Hence it may be accessed and used without the physical presence of the knowledge creator.

Conversely, the ontological dimension concerns the level of knowledge sharing (individual,

group, organization, openness only to partners, full openness).
There are two main reasons for selecting these dimensions to map a supplier's knowledge: it is by far the most commonly used by managers and scholars in the field of knowledge management, and it is familiar to supplier managers and therefore easy to use in field investigations.
Starting from these premises, each supplier was divided into five macro-areas: planning, production, organization, market, and strategic relationships so as to provide a map of a given supplier's knowledge on the basis of the ontological and epistemological dimensions. More specifically, two managers from each supplier were involved in identifying the degree of formalization and the degree of sharing of the supplier's knowledge for each of the five macro-areas. The fuzzy set theory (FST) based approach (Zadeh, 1965; Watanabe, 1979) was used to process the information gained during the meetings with the two managers. This approach makes it possible to integrate the rigour of logic with the natural language model and common-sense reasoning (Michellone and Zollo, 2000; Zimmermann, 2001).
In particular, the degree of formalization and the degree of sharing of each supplier's knowledge per macro-area were established as shown in the following five steps:

1. A *first term set* of five qualitative judgments was defined in order to identify the degree of formalization of the supplier's knowledge: VPF (very poorly formalized), PF (poorly formalized), MF (medium formalized), SF (significantly formalized), VSF (very significantly formalized).
2. A *second term set* of five qualitative judgments was defined to identify the degree of sharing of the supplier's knowledge: MI (mainly individual), IG (inside group), IO (inside organization), OP (open to partner), FO (fully open).
3. Two managers were involved in a focus group with two researchers to identify the degree of formalization (DF) and the degree of sharing (DS) of the supplier's knowledge for each of the five macro-areas;
4. Each qualitative value was codified into the correspondent fuzzy number (Figure 1a and Figure 1b).
5. These fuzzified values make it possible to create a fuzzy map of the knowledge categorized by the epistemological dimension (DF) and the ontological dimension (DS) for each macro-area. Specifically, each pair of qualitative values associated with the degree of formalization and the degree of sharing of a supplier's knowledge used in one of the five macro-areas is represented by a 3D fuzzy set that may be either a pyramid or a truncated square pyramid. The combination of the 3D fuzzy sets associated to the five macro-areas identifies the epistemological and ontological map of the supplier's knowledge.

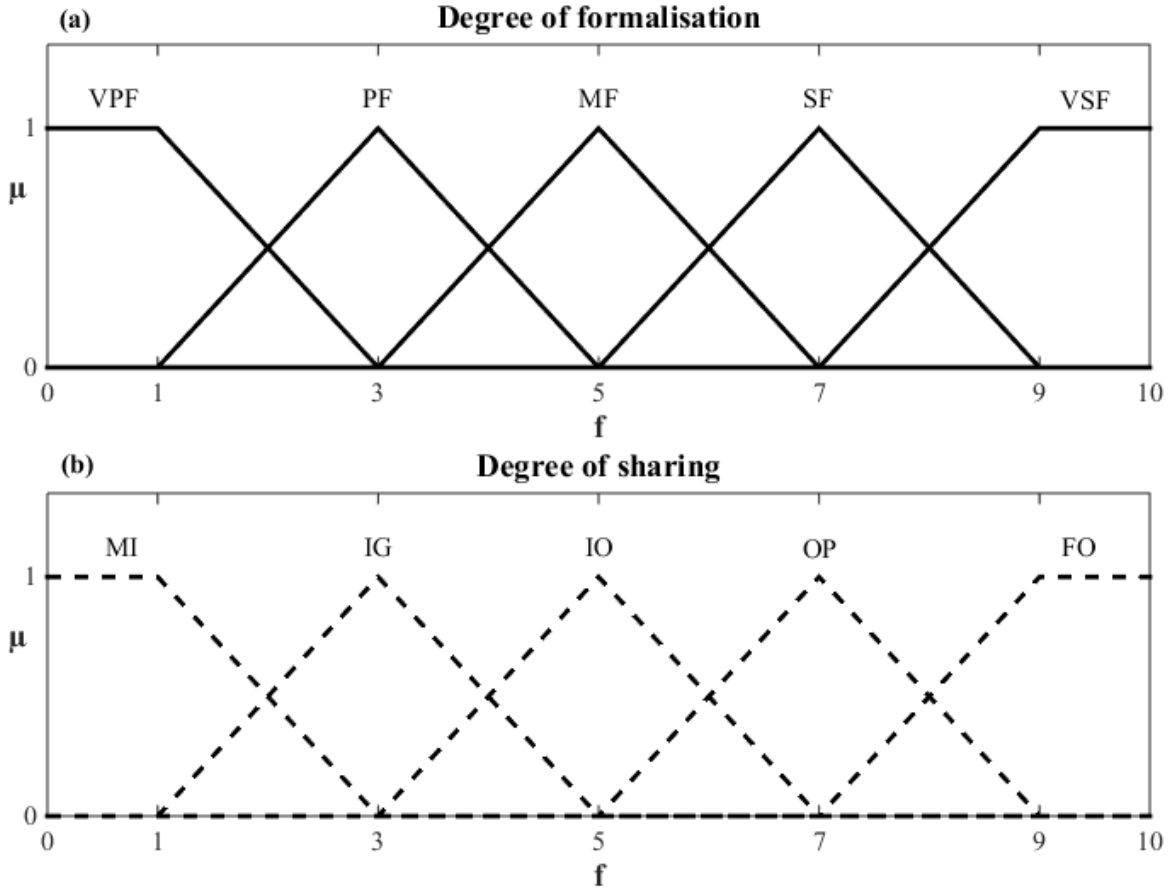


Figure 1. Fuzzy term sets for (a) the Degree of formalization (epistemological dimension) and (b) the Degree of sharing (ontological dimension)

2.2 Mapping Knowledge Management Systems

According to Cerchione and Esposito (2017), KMSs are divided into two groups for this research: Knowledge Management Tools (KM-Tools, defined as the specific IT-based systems supporting KM methods and techniques) and Knowledge Management Practices (KM-Practices, defined as methods and techniques to support the processes of knowledge creation, storage, transfer/sharing, and application).

A group comprising four experts, two senior IT consultants and two researchers, was involved to identify the epistemological and ontological dimensions of KM-Tools and KM-Practices. A Delphi panel was used to converge the answers provided by the expert group (Okoli and Pawlowski, 2004; Hsu and Sandford, 2007). During the meetings, the group of experts identified a couple of shared judgements about the degree of formalization and the degree of sharing of each individual KM-Tool and KM-Practice, applying the five-level scale used to assess the supplier's knowledge (Figure 1a and Figure 1b). The final list of KM-Tools and KM-Practices identified is reported in Table 1.

Each pair of fuzzy numbers, which represents the degree of formalization and the degree of sharing of the individual KM-Tool (or KM-Practice) used by the supplier, identifies a 3D fuzzy set that may be either a pyramid or a truncated square pyramid. The combination of these 3D fuzzy sets associated to the individual KM-Tool (or KM-Practice) identifies the epistemological

and ontological map of KM-Tools (or a map of KM-Practices) used by the supplier (Figure 2). The final list of KM-Tools and KM-Practices identified is reported in Table 1.

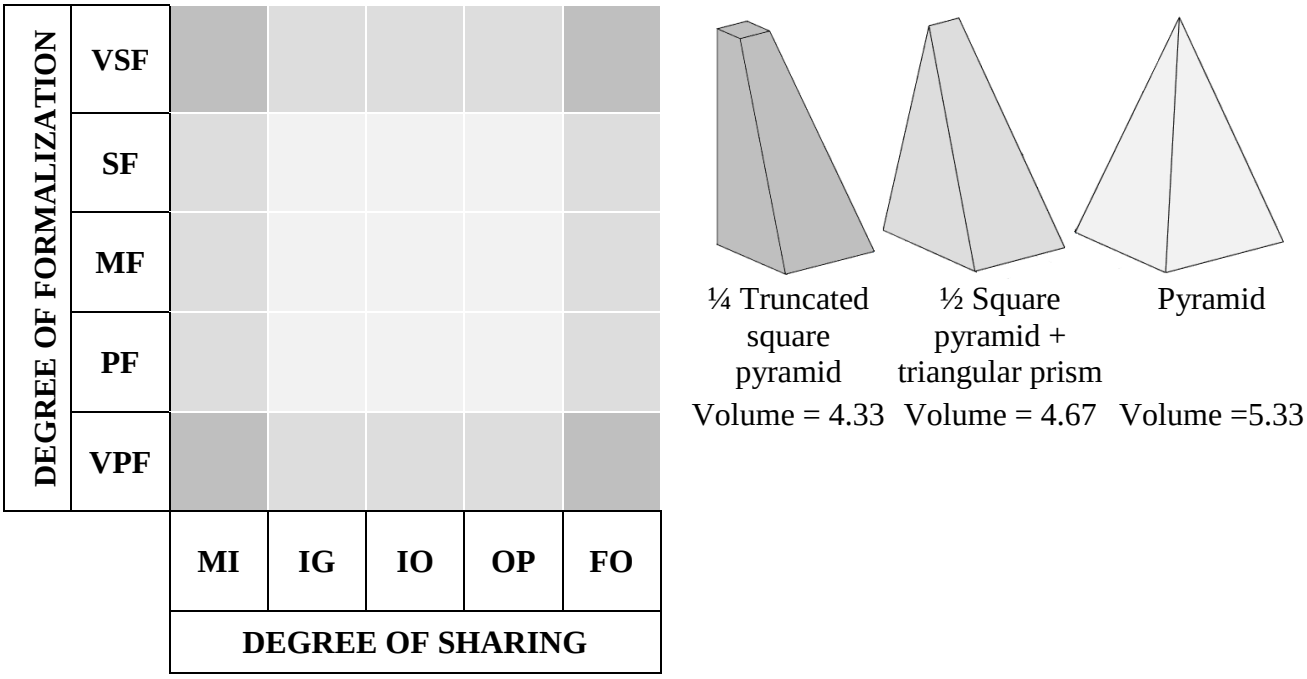


Figure 2. KM-Tools and KM-Practices map

Table 1. KM-Tools and KM-Practices list

KM-Tools			KM-Practices		
	DF	DS		DF	DS
Blogs	VPF = (0,0,1,3)	FO = (7,9,10,10)	After Action Review	PF = (1,3,3,5)	IO = (3,5,5,7)
Business Process Management Systems	SF = (5,7,7,9)	IO = (3,5,5,7)	Balance Scorecard	SF = (5,7,7,9)	IG = (1,3,3,5)
Chat	VPF = (0,0,1,3)	FO = (7,9,10,10)	Benchmarking	VSF = (7,9,10,10)	IG = (1,3,3,5)
Cloud Computing	MF = (3,5,5,7)	OP = (5,7,7,9)	Best Practice	MF = (3,5,5,7)	IO = (3,5,5,7)
Collaborative Filtering	PF = (1,3,3,5)	OP = (5,7,7,9)	Brainstorming	VPF = (0,0,1,3)	IG = (1,3,3,5)
Configuration Management Systems	MF = (3,5,5,7)	IG = (1,3,3,5)	Case Based Reasoning	VPF = (0,0,1,3)	IG = (1,3,3,5)
Content Management Systems	PF = (1,3,3,5)	FO = (7,9,10,10)	Casual Mapping	SF = (5,7,7,9)	IO = (3,5,5,7)
Conversational Technologies	VPF = (0,0,1,3)	FO = (7,9,10,10)	Coaching/Mentoring	VPF = (0,0,1,3)	MI = (0,0,1,3)
Crowdsourcing Systems	VPF = (0,0,1,3)	FO = (7,9,10,10)	Communities of Practice	VPF = (0,0,1,3)	FO = (7,9,10,10)
Databases	SF = (5,7,7,9)	IG = (1,3,3,5)	Communities of Sharing	VPF = (0,0,1,3)	FO = (7,9,10,10)
Data Management Systems	SF = (5,7,7,9)	IG = (1,3,3,5)	Contextual Inquiry	PF = (1,3,3,5)	IO = (3,5,5,7)
Data Mining	VSF = (7,9,10,10)	IO = (3,5,5,7)	Facilitated Discussion	VPF = (0,0,1,3)	IG = (1,3,3,5)
Data Visualisation	VSF = (7,9,10,10)	IO = (3,5,5,7)	Focus Groups	VPF = (0,0,1,3)	OP = (5,7,7,9)
Data Warehouse	SF = (5,7,7,9)	IG = (1,3,3,5)	Ideas Competition	PF = (1,3,3,5)	FO = (7,9,10,10)
Decision Support Systems	VSF = (7,9,10,10)	IG = (1,3,3,5)	Informal Networks	VPF = (0,0,1,3)	IO = (3,5,5,7)
Document Management Systems	PF = (1,3,3,5)	IG = (1,3,3,5)	Job Rotation	VPF = (0,0,1,3)	MI = (0,0,1,3)
E-mail	VPF = (0,0,1,3)	FO = (7,9,10,10)	Knowledge Cafes	VPF = (0,0,1,3)	IO = (3,5,5,7)
ERP Systems	MF = (3,5,5,7)	IO = (3,5,5,7)	Knowledge Elicitation Interview	PF = (1,3,3,5)	OP = (5,7,7,9)
Expert Systems	VSF = (7,9,10,10)	IO = (3,5,5,7)	Knowledge Filtering	VSF = (7,9,10,10)	IO = (3,5,5,7)
Learning Management Systems	PF = (1,3,3,5)	IO = (3,5,5,7)	Knowledge Mapping	SF = (5,7,7,9)	IO = (3,5,5,7)
Mash-up	PF = (1,3,3,5)	FO = (7,9,10,10)	Knowledge Modelling	VSF = (7,9,10,10)	IO = (3,5,5,7)
Peer-to-Peer Resource Sharing	MF = (3,5,5,7)	FO = (7,9,10,10)	Knowledge Office	MF = (3,5,5,7)	FO = (7,9,10,10)
Podcasting/Videocasting	VPF = (0,0,1,3)	FO = (7,9,10,10)	Learning by Doing	VPF = (0,0,1,3)	MI = (0,0,1,3)
Prediction and Idea Markets	VPF = (0,0,1,3)	FO = (7,9,10,10)	Lesson Learned	PF = (1,3,3,5)	IG = (1,3,3,5)
Product Data Management Systems	SF = (5,7,7,9)	IG = (1,3,3,5)	Meeting/Task Force	VPF = (0,0,1,3)	OP = (5,7,7,9)
Product Lifecycle Management Systems	SF = (5,7,7,9)	IG = (1,3,3,5)	Problem Solving	MF = (3,5,5,7)	IG = (1,3,3,5)
Social Data Mining	VSF = (7,9,10,10)	FO = (7,9,10,10)	Process Mapping	SF = (5,7,7,9)	IO = (3,5,5,7)
Social Media	VPF = (0,0,1,3)	FO = (7,9,10,10)	Projects Team Training	VPF = (0,0,1,3)	IG = (1,3,3,5)
Syndication Systems	PF = (1,3,3,5)	FO = (7,9,10,10)	Rating	VSF = (7,9,10,10)	IG = (1,3,3,5)

Text Mining	PF = (1,3,3,5)	IO = (3,5,5,7)	Seminars	VPF = (0,0,1,3)	OP = (5,7,7,9)
Trust and Reputation Systems	VPF = (0,0,1,3)	FO = (7,9,10,10)	Social Network Analysis	VSF = (7,9,10,10)	FO = (7,9,10,10)
Video/Audio conference	VPF = (0,0,1,3)	OP = (5,7,7,9)	Storytelling	MF = (3,5,5,7)	OP = (5,7,7,9)
Wiki	PF = (1,3,3,5)	FO = (7,9,10,10)	Work Groups	VPF = (0,0,1,3)	IG = (1,3,3,5)

2.3 Efficiency and effectiveness indices

In this section, two couples of indices are proposed. The first pair of indices evaluates the degree of efficiency and the degree of effectiveness of KM-Tools in relation to the supplier's knowledge. The second measures the degrees of efficiency and effectiveness of KM-Practices in relation to the supplier's knowledge.

TOY (Efficiency of KM-Tools) = $\frac{K \cap T}{T}$; (1)

TOS (Effectiveness of KM-Tools) = $\frac{K \cap T}{K}$; (2)

PRY (Efficiency of KM-Practices) = $\frac{K \cap P}{P}$; (3)

PRS (Effectiveness of KM-Practices) = $\frac{K \cap P}{K}$; (4)

In these indices,

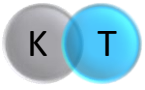
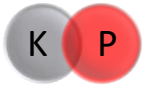
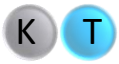
- **K** represents the supplier's knowledge, i.e. the union of five 3D fuzzy sets associated with the firm's knowledge in the five macro-areas of planning, production, organization, market, and strategic relationships;
- **T** regards the KM-Tools used by the supplier, i.e. the union of 3D fuzzy sets associated with the individual KM-Tools adopted by the supplier;
- **P** depicts the KM-Practices used by the supplier, i.e. the union of 3D fuzzy sets associated with the individual KM-Practices used by the supplier.

Each index ranges from zero to one depending on the level of intersection between the two variables used for the specific index. Table 2 summarizes all the five possible intersections for the proposed indices.

The TOY index measures the degree of efficient use of KM-Tools in relation to the supplier's knowledge in the epistemological and ontological dimensions. The hypothesis is that the higher the percentage of KM-Tools (T) intersecting with the supplier's knowledge (K), the higher the percentage of adopted KM-Tools suited to the characteristics of the supplier's knowledge, and the higher the level of efficiency. The TOY index is zero if the 3D fuzzy sets associated to T and K are disjointed (case B in Table 2). In this case, the supplier does not adopt KM-Tools suited to the characteristics of its knowledge. This means that the supplier uses inadequate KM-Tools in its knowledge management process, which implies dissipation of resources and serious problems of inefficiency (inefficient use of KM-Tools). By contrast, the TOY index is equal to one if T coincides with K (case E in Table 2). This means that there is a close correspondence between the KM-Tools used and the supplier's knowledge. Hence, all the KM-Tools are suited to the characteristics of the firm's knowledge (efficient use of KM-Tools). Even if T is a proper subset

of K (case C in Table 2), the index is equal to one. In this case, there is no strict correspondence between the KM-Tools and the supplier's knowledge because all the KM-Tools are appropriate to the supplier's knowledge, but not all the supplier's knowledge is covered by the KM-Tools.
The TOS index measures the degree of effectiveness of KM-Tools in relation to the supplier's knowledge in the epistemological and ontological dimensions. The hypothesis is that the higher the percentage of the supplier's knowledge (K) intersecting with KM-Tools (T), the higher the percentage of the supplier's knowledge covered by appropriate KM-Tools, and the higher the level of effectiveness. The TOS index is equal to zero if the 3D fuzzy sets associated with T and K are disjointed (case B of Table 2). In this case, no part of the supplier's knowledge (K) is covered by the KM-Tools (T) adopted. This means that beyond the issues of inefficiency already pointed out, there are also problems of ineffectiveness since the KM-Tools do not satisfy the supplier's needs in terms of knowledge management (ineffectiveness of KM-Tools). The TOS index is equal to 1 if K coincides with T (case E in Table 2) or if K is a proper subset of T (case D in Table 2). This means that all the supplier's knowledge is covered by the KM-Tools. Hence, the KM-Tools are able to satisfy the supplier's needs in terms of knowledge management (effectiveness of KM-Tools). Nevertheless, in case E there is a full intersection between K and T (both efficiency and effectiveness) whereas in case D, part of T is outside the intersection (effectiveness but no efficiency).
To summarize, case A (Table 2) shows a context in which a part of the KM-Tools is not aligned with the supplier's knowledge (low level of efficiency) and a part of the supplier's knowledge is not covered by the KM-Tools (low level of effectiveness). Case B represents a situation of complete inadequacy (inefficiency and ineffectiveness). Case C highlights a condition of efficiency, since all the KM-Tools are used in a proper way, but there is a lack of effectiveness because part of the supplier's knowledge is not covered by the KM-Tools. Case D represents a condition of effectiveness since all the supplier's knowledge is covered by proper KM-Tools, but there is a lack of efficiency since a part of the KM-Tools does not correspond with the supplier's knowledge. Lastly, case E shows a condition of full efficiency and effectiveness.
Similarly, the PRY and PRS indices respectively depict the level of efficient use of KM-Practices in relation to the supplier's knowledge and the index of effectiveness of KM-Practices in relation to the supplier's knowledge.
The following section provides an overview of the research context in which the field analysis was conducted.

Table 2. Alignment indices by 3D fuzzy term sets

	INDICES					
	K-T			K-P		
	3D TERM SETS	TOY	TOS	3D TERM SETS	PRY	PRS
A		[0, 1]	[0, 1]		[0, 1]	[0, 1]
B		0	0		0	0
C		1	[0, 1]		1	[0, 1]

D		[0, 1]	1		[0, 1]	1
E		1	1		1	1

3. Field analysis and context of investigation

Sixty-one suppliers were investigated to shed light on the level of alignment between a supplier's knowledge and its KMSs. The methodology for the analysis is based on semi-structured face-to-face interviews. This methodology has the following dual advantage (Qu and Dumay, 2011):

- It does not limit the interview to a set of predefined answers. This makes it possible to catch weak signals that might not otherwise emerge using predetermined questions, and
- The use of predetermined questions gives uniformity to the investigation.

The investigation was organized into the following six steps:

1) *Preparation of the draft semi-structured questionnaire*. In this phase, a draft version of the semi-structured questionnaire was prepared taking into account the basic objectives of the investigation.
2) *Establishment of a focus group*. In this phase, a focus group including researchers and senior IT consultants operating in the field of KM was established. It was set up in three different phases. Firstly, the topic investigated was presented in order to familiarize the focus group participants with it. Secondly, the draft semi-structured questionnaire was submitted to the panelists in order to receive their useful feedback and comments. Lastly, the panelists' remarks were discussed in a plenary session.
3) *Re-focusing the semi-structured questionnaire*. The semi-structured questionnaire was revised and finalized on the basis of the feedback received during the focus group discussion.
4) *Testing the semi-structured interview*. In this step, the final version of the semi-structured questionnaire was tested by means of pilot interviews with three suppliers.
5) *Final version of the questionnaire*. Suggestions emerging during pilot interviews with the three suppliers were included in the final version of the questionnaire.
6) *Field analysis implementation*. The semi-structured questionnaire was submitted during face-to-face interviews involving at least two managers with different skills and roles (e.g. a manager involved in the supply firm's strategic decision-making process and a manager involved in operations management). This made it possible to obtain both strategic and operational perspectives. The total number of respondents was 61 out of 78 supply firms with a response rate of 78.2%.

The field analysis was carried out on a sample of 61 suppliers located in the South of Italy. The sample includes medium (36%), small (49%) and micro suppliers as shown in Table 3.

Table 3. Breakdown of suppliers by employee bands

suppliers category	Number of suppliers	%
Micro (0-9)	9	15
Small (10-49)	30	49

Medium (50-249)	22	36
Total	61 Suppliers	

Table 4 shows that 61% of suppliers operate in high-tech and complex manufacturing industries, such as aerospace, the automotive industry, and engineering. 39% operate in the service industry, such as information and communications technology, research and development, and services.

Table 4. Supplier industries

Overall economic industry	Specific industry	Number of Supplies	%
Manufacturing	Aerospace	12	20
	Automotive	20	33
	Engineering	5	8
Service	Research and Development	7	11
	Information and Communications Technology	14	23
	Management Consulting	3	5
Total		61 Suppliers	

Moreover, suppliers have been selected for the following two main reasons:

- they are part of important supply systems operating in high-tech and complex manufacturing and service industries with a critical impact on the territorial development of an Italian region that is a long-established leader in producing complex components for the aerospace and automotive industries
- knowledge management plays an important role since all the suppliers operate in high-tech and complex industries, where knowledge is a critical factor.

The above characteristics make the chosen sample relevant for this study and make it possible to consider the suppliers in question an appropriate context for enquiry.
The following section presents the results of the field analysis.

4. Results

This section presents the main findings for the four indices of efficiency and effectiveness emerging from analysis of the 61 surveyed Suppliers. Nevertheless, to show how the proposed methodology works in practice, section 4.1 shows how it was implemented in the case of an individual supplier. The results of the survey will be discussed in section 4.2.

4.1 Implementation to an individual supplier

The supplier analysed is located in southern Italy with other plants located in Italy and USA. The supplier operates in the aircraft industry and its main activities regard the manufacturing and assembly of aircraft airframes as well as the design and production of aeronautical parts.
The three phases of the methodology are illustrated below.

First phase – Mapping the supplier's knowledge
For this supplier, the survey has evidenced that knowledge is, by and large, very significantly

formalized (VSF). Nevertheless, in the Planning and Organization macro-areas, knowledge is manly individual (MI), whereas in the Production, Market and Strategic relationships areas, knowledge is shared inside the organization (IG) (Table 5).

Table 5. Fuzzy numbers associated with suppliers' knowledge

Macro area	***Degree of formalization***	***Degree of sharing***
Planning	VSF = (7,9,10,10)	MI = (0,0,1,3)
Production	VSF = (7,9,10,10)	IG = (1,3,3,5)
Organisation	VSF = (7,9,10,10)	MI = (0,0,1,3)
Market	VSF = (7,9,10,10)	IG = (1,3,3,5)
Strategic relationships	PF = (1,3,3,5)	IG = (1,3,3,5)

Each pair of fuzzified values concerning the degree of formalization and the degree of knowledge sharing (Table 5) allows us to identify the 3D fuzzy map representative of the supplier's knowledge for each macro-area Figure 3.

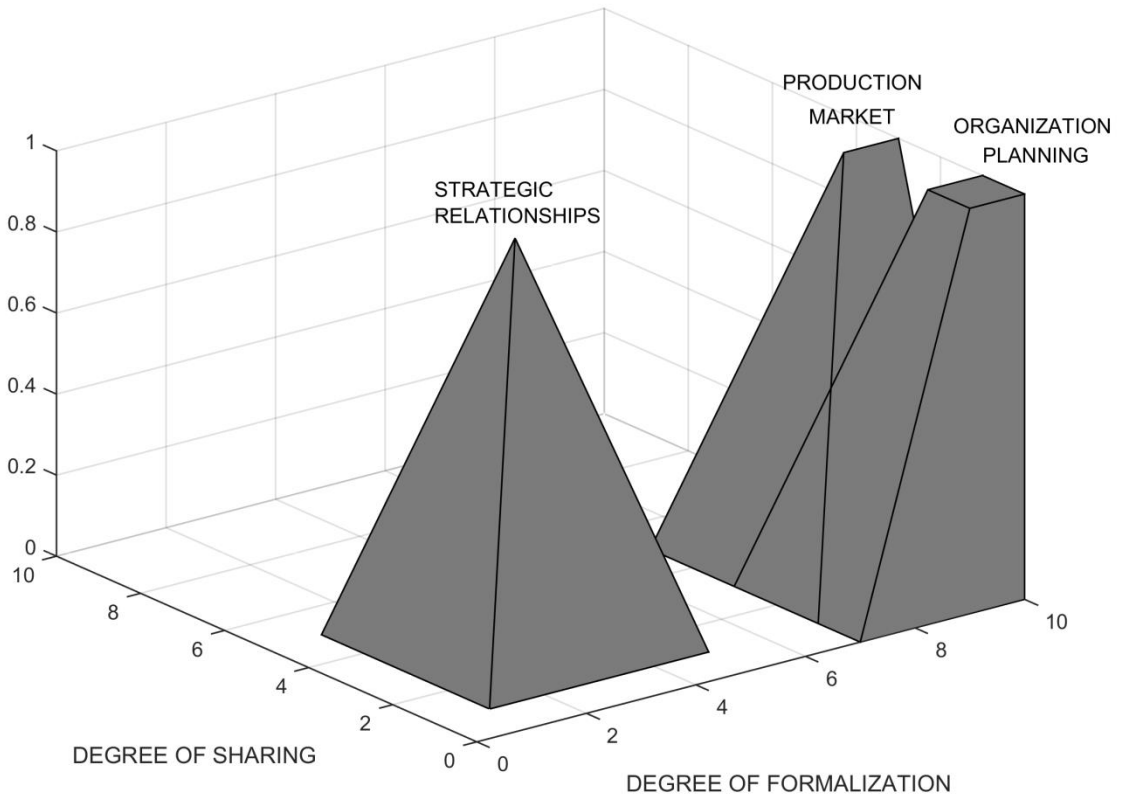


Figure 3. The supplier's knowledge

Second phase – Mapping KM-Tools and KM-Practices

Turning now to the KM-Tools, the supplier uses *E-mail*, which is a very poorly formalized and

fully open tool, so it is suited to mainly human-embedded knowledge management, an *ERP system*, which is a medium formalized tool useful for sharing knowledge inside the organization, and *Data Warehouse*, a significantly formalized tool suitable for sharing formalized knowledge within a specific group (Table 6).

Table 6. Fuzzy numbers associated with KM-Tools

KM-Tools	Fuzzy numbers	
	Degree of formalization	**Degree of sharing**
Data Warehouse	SF = (5,7,7,9)	IG = (1,3,3,5)
E-mail	VPF = (0,0,1,3)	FO = (7,9,10,10)
ERP System	MF = (3,5,5,7)	IO = (3,5,5,7)

Each pair of fuzzified values, which represents the degree of formalization and the degree of sharing of each KM-Tool, identifies the epistemological and ontological map of KM-Tools (Figure 4).

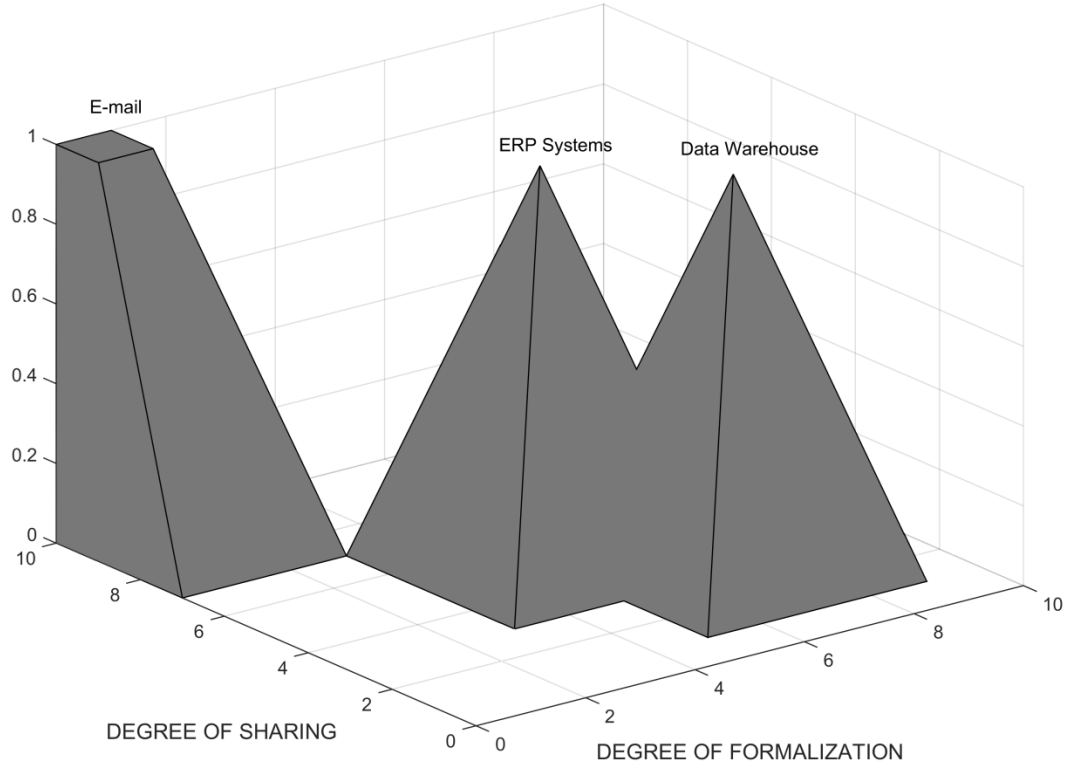


Figure 4. KM-Tools

Regarding KM-Practices, the survey has evidenced that the supplier uses (Table 7) *Learning by doing* and *Coaching/Mentoring*, which are very poorly formalized practices suited to human-embedded knowledge, *Brainstorming* and *Work groups*, very poorly formalized practices useful for knowledge sharing inside a group, *After action review*, a poorly formalized practice useful for knowledge sharing inside the organization, *Problem solving*, a medium formalized practice suited to knowledge sharing inside a group, *Process mapping* and *Knowledge mapping*, which are significantly formalized practices useful for knowledge sharing inside an organization, and the *Meeting/Task Force*, a very poorly formalized practice shared with partners.

Table 7. Fuzzy numbers associated with KM-Practices

KM-Practices	Fuzzy numbers	
	Degree of formalization	Degree of sharing
After Action Review	PF = (1,3,3,5)	IO = (3,5,5,7)
Brainstorming	VPF = (0,0,1,3)	IG = (1,3,3,5)
Coaching/Mentoring	VPF = (0,0,1,3)	MI = (0,0,1,3)
Knowledge Mapping	SF = (5,7,7,9)	IO = (3,5,5,7)
Learning by Doing	VPF = (0,0,1,3)	MI = (0,0,1,3)
Meeting/Task Force	VPF = (0,0,1,3)	OP = (5,7,7,9)
Problem Solving	MF = (3,5,5,7)	IG = (1,3,3,5)
Process Mapping	SF = (5,7,7,9)	IO = (3,5,5,7)
Work Groups	VPF = (0,0,1,3)	IG = (1,3,3,5)

As for KM-Tools, using the fuzzy values shown in Table 7 it is possible to identify the epistemological and ontological map of KM-Practices (Figure 5).

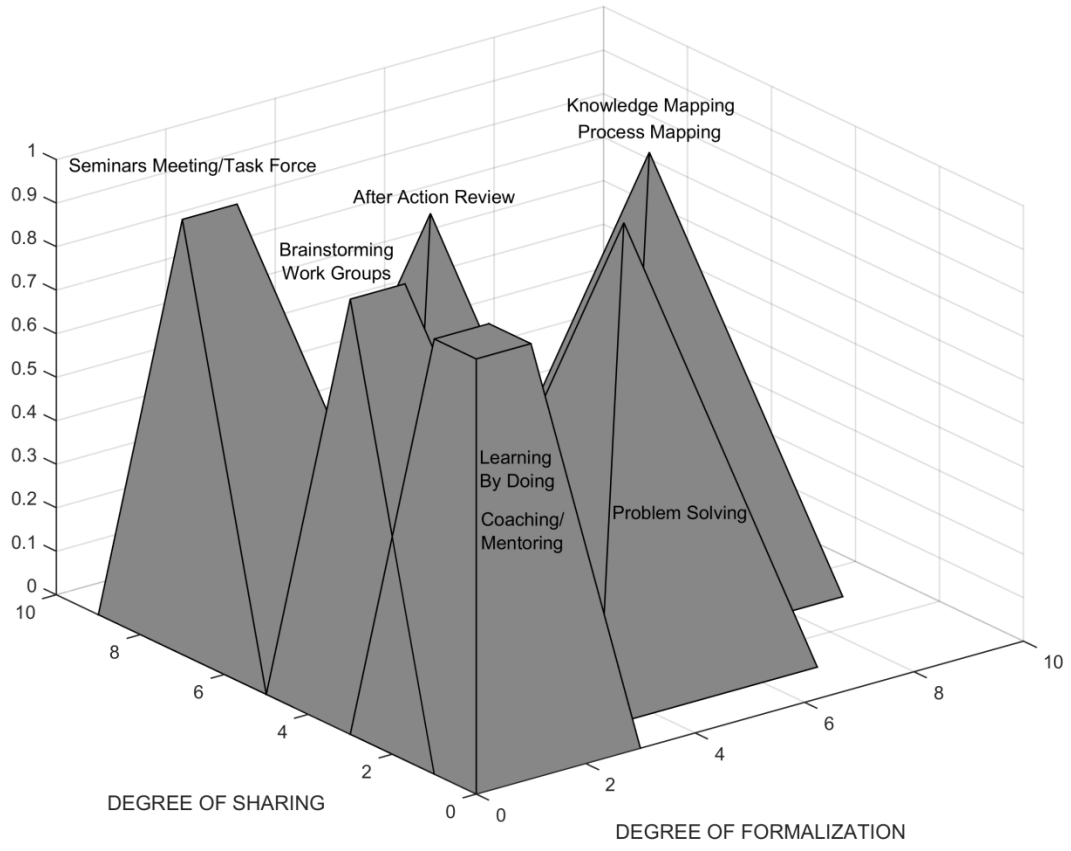


Figure 5. KM-Practices

Third phase – Building efficiency and effectiveness indices

In order to formulate efficiency and effectiveness indices it was necessary to calculate two 3D fuzzy intersections:

1- The intersection between knowledge (Figure 3) and KM-Tools (Figure 4) as illustrated in Figure 6
2- The intersection between knowledge (Figure 3) and KM-Practices (Figure 5) as illustrated in Figure 7

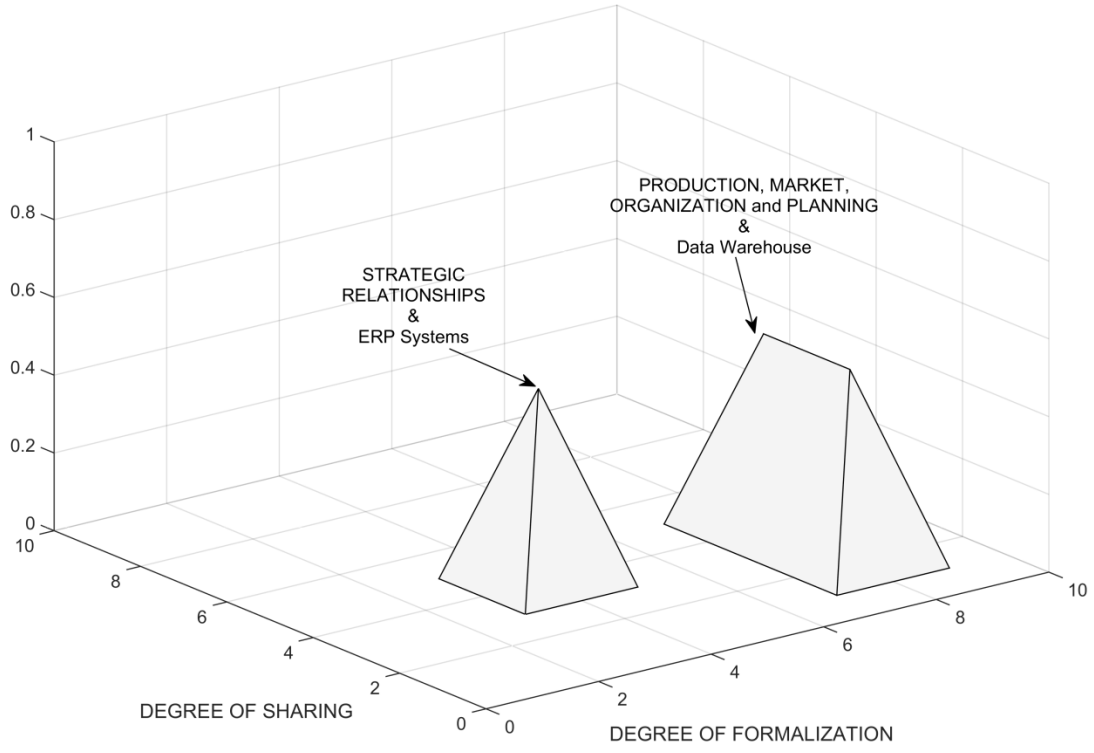


Figure 6. Intersection between Knowledge and KM-Tools

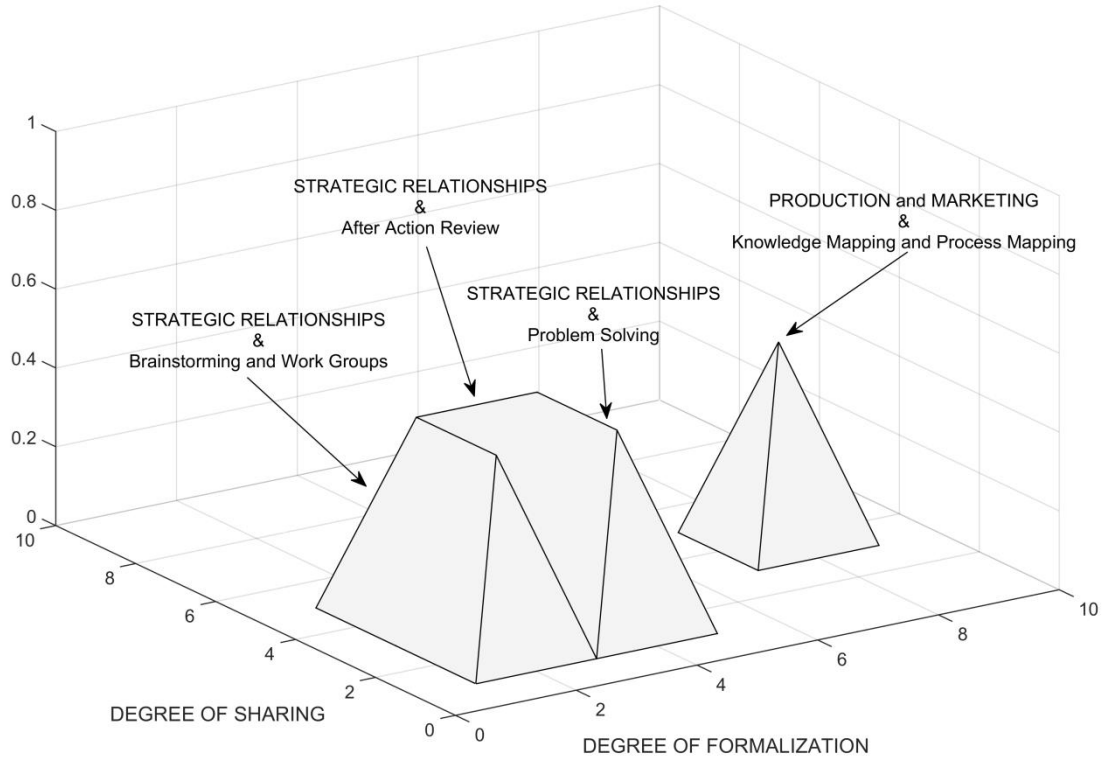


Figure 7. Intersection between Knowledge and KM-Practices

Finally, the four indices for the selected supplier are calculated using the formulas (1), (2), (3) and (4):
TOY = 0.16
TOS = 0.18
PRY = 0.17
PRS = 0.33

After showing how the methodology is applied to an individual supplier, the next step illustrates the results of the survey.

4.2 Survey results

This section provides the main findings for the 61 suppliers surveyed. The objective is to calculate the degree of efficiency and effectiveness of KM-Tools and KM-Practice (Table 8) and highlights differences and similarities among the surveyed suppliers.

Table 8. Efficiency and effectiveness indices for KM-Tools and KM-Practices

Supplier	INDICES			
	KM-Tools in relation to the supplier's knowledge		KM-Practices in relation to the supplier 's knowledge	
	TOY	TOS	PRY	PRS
A1	0.43	0.60	0.34	0.75
A2	0.28	0.55	0.31	0.69

A3	0.44	0.46	0.48	0.76
A4	0.28	0.71	0.33	1.00
A5	0.36	0.33	0.37	0.69
A6	0.19	0.19	0.47	0.74
A7	0.00	0.00	0.09	0.19
A8	0.37	0.86	0.43	0.81
A9	0.34	0.60	0.34	0.75
A10	0.47	0.38	0.20	0.22
A11	0.30	0.55	0.18	0.41
A12	0.24	0.70	0.17	0.57
A13	0.34	0.60	0.31	0.67
A14	0.32	0.75	0.21	0.53
A15	0.17	0.64	0.14	0.64
A16	0.25	0.71	0.30	1.00
A17	0.27	0.87	0.30	0.87
A18	0.18	0.46	0.21	0.66
A19	0.44	0.83	0.27	0.49
A20	0.43	0.60	0.34	0.75
A21	0.70	0.58	0.37	0.46
A22	0.47	0.40	0.33	0.58
A23	0.00	0.00	0.45	0.44
A24	0.38	0.67	0.38	0.85
A25	0.26	0.51	0.33	0.81
A26	0.06	0.18	0.05	0.21
A27	0.41	0.82	0.42	0.91
A28	0.32	0.64	0.18	0.47
A29	0.47	0.70	0.24	0.33
A30	0.38	1.00	0.23	0.63
A31	0.43	0.83	0.27	0.64
A32	0.26	0.41	0.40	0.67
A33	0.33	0.46	0.32	0.59
A34	0.24	0.43	0.43	0.59
A35	0.42	0.60	0.22	0.33
A36	0.19	0.19	0.53	0.67
A37	0.22	0.58	0.23	0.58
A38	0.25	0.82	0.26	0.78
A39	0.17	0.67	0.22	0.78
A40	0.18	0.64	0.16	0.52
A41	0.38	0.72	0.29	0.62
A42	0.48	0.86	0.44	0.82
A43	0.43	0.62	0.36	0.51
A44	0.25	1.00	0.23	0.82
A45	0.16	0.18	0.17	0.33
A46	0.07	0.07	0.25	0.55
A47	0.38	0.49	0.30	0.64
A48	0.16	0.50	0.05	0.18
A49	0.38	0.58	0.36	0.64
A50	0.13	0.20	0.30	0.48
A51	0.26	0.41	0.24	0.37
A52	0.11	0.11	0.43	0.71
A53	0.19	0.40	0.19	0.49
A54	0.24	0.82	0.21	0.82
A55	0.23	0.64	0.12	0.40
A56	0.26	0.70	0.31	0.78

A57	0.26	0.46	0.31	0.56
A58	0.44	0.80	0.41	0.80
A59	0.13	0.13	0.40	0.87
A60	0.50	0.85	0.40	0.92
A61	0.19	0.53	0.19	0.61
Mean	**0.29**	**0.55**	**0.29**	**0.62**

Table 8 highlights that the efficiency index of KM-Tools compared with the supplier's knowledge ranges from 0.00 (suppliers A7, A23) to 0.70 (A21) with a mean of 0.29, whereas the effectiveness index ranges from 0.00 (A7, A23) to 1.00 (A30, A44) with a mean of 0.55. It is possible to identify four areas limited by the average values of the two indices (Figure 8).
In the top left quadrant there are suppliers that adopt KM-Tools with a low degree of efficiency, but a high degree of effectiveness. This is the *area of inefficiency* for KM-Tools.13 of the 61 suppliers are located in this area. The bottom left quadrant contains the suppliers that adopt inefficient and ineffective KM-Tools. This is the *area of inefficiency and ineffectiveness*. 20 out of 61 suppliers are located in this area. The suppliers that adopt KM-Tools with a high degree of efficiency, but a low degree of effectiveness, are in the bottom right quadrant. This is the *area of ineffectiveness* for KM-Tools. 7 out of the 61 suppliers are located in this area. Lastly, in the top right quadrant we find suppliers whose KM-Tools have a high degree of both efficiency and effectiveness. This is the *area of efficiency and effectiveness*. 21 out of the 61 suppliers are in this area.

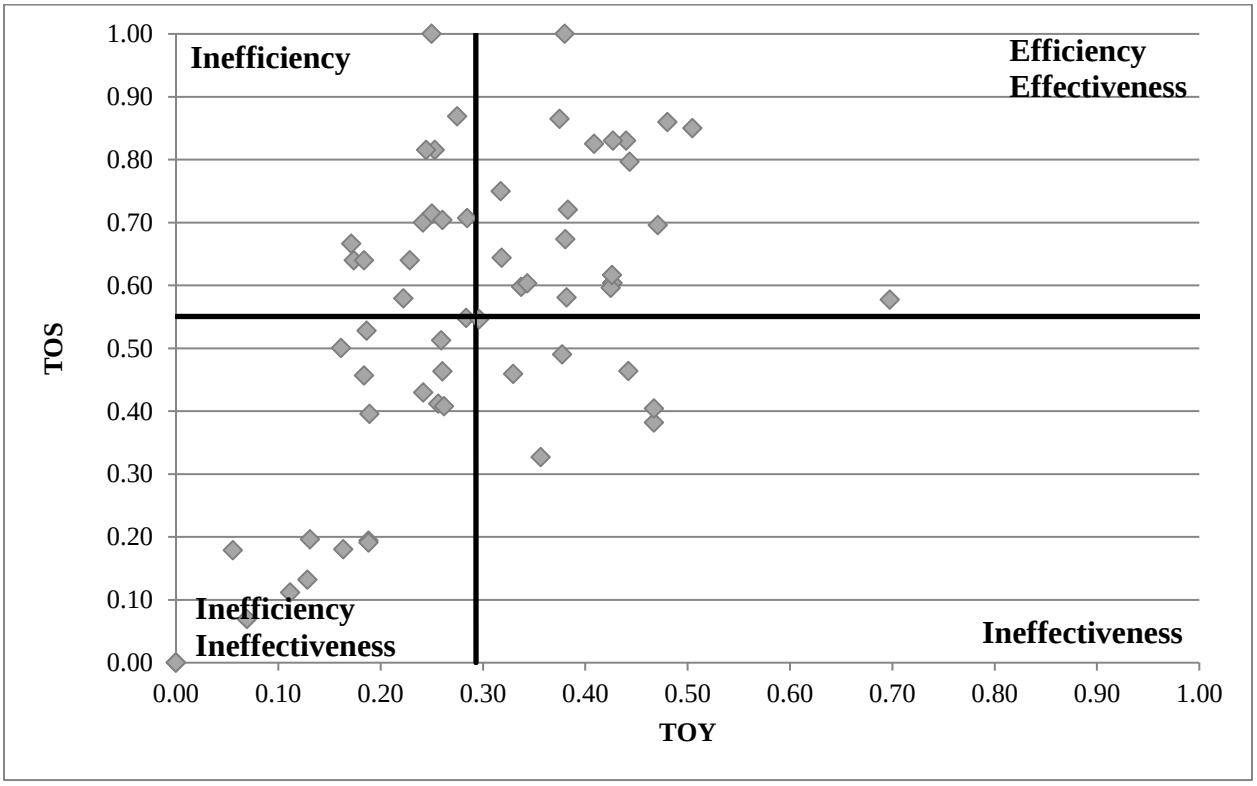


Figure 8. The relationship between TOY and TOS

To sum up, Figure 8 shows that only 36% of suppliers have efficient and effective KM-Tools in relation to their knowledge. The remainder of the suppliers have problems of inefficiency and/or ineffectiveness (64%).

Looking now at KM-Practices, Table 8 shows that the index of efficiency of KM-Practices in relation to a supplier's knowledge ranges from 0.05 (suppliers A26, A48) to 0.53 (A36) with a mean of 0.29, whereas the effectiveness index ranges from 0.18 (A48) to 1.00 (A04, A16) with a mean of 0.62. Also in this case it is possible to identify four areas on the basis of the average values of the two indices (Figure 9). The top left quadrant contains suppliers that adopt effective, but inefficient, KM-Practices. This is the *area of inefficiency* for KM-Practices. 8 out of the 61 suppliers are located in this area.
The bottom left quadrant contains suppliers with inefficient and ineffective KM-Practices. This is the *area of inefficiency and ineffectiveness*. 20 out of 61 suppliers are located in this area. The bottom right quadrant contains suppliers that adopt KM-Practices with a high degree of efficiency, but a low degree of effectiveness. This is the *area of ineffectiveness*. 8 out of 61 suppliers are located in this area.
Lastly, in the top right quadrant we find suppliers with both efficient and effective KM-Practices. This is the *area of efficiency and effectiveness*. 25 out of the 61 suppliers are located in this area.

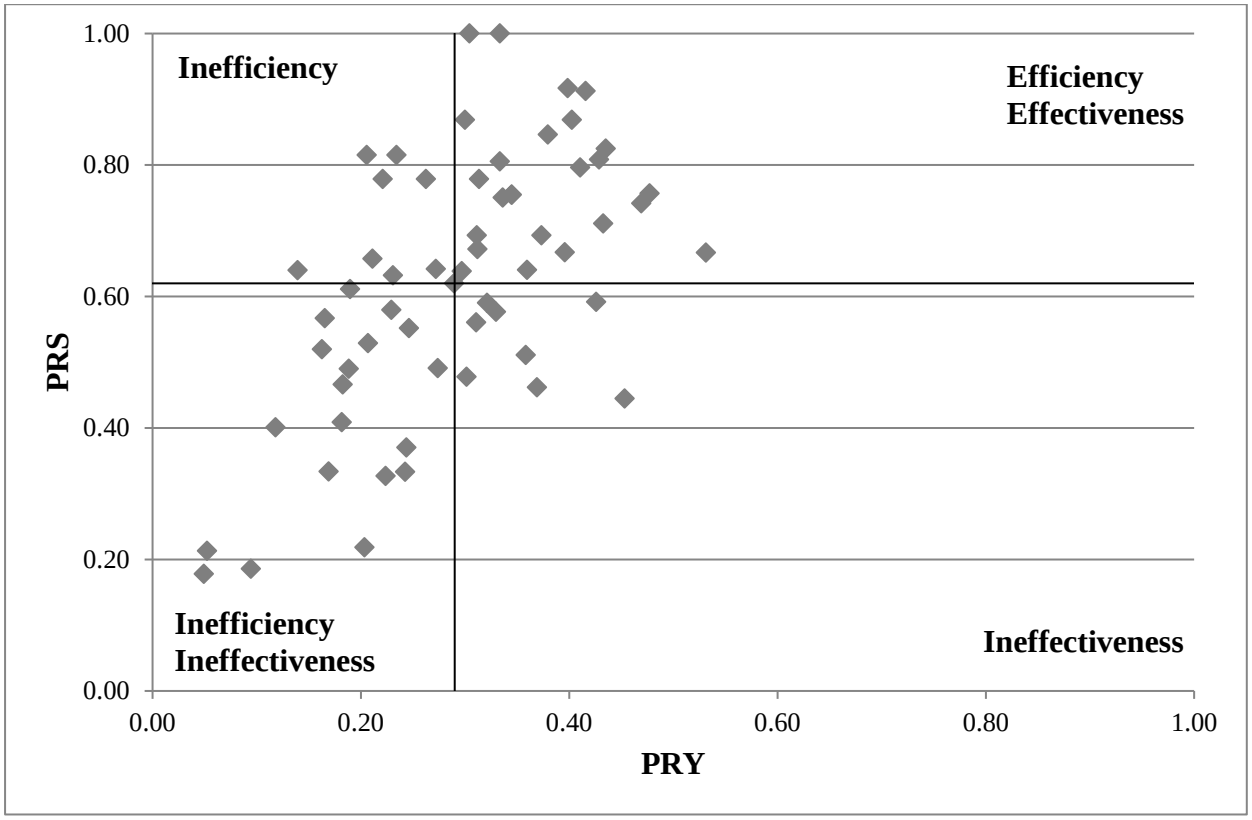


Figure 9. The relationship between PRY and PRS

Moreover, comparing the area of efficiency and effectiveness of KM-Tools (21 suppliers) and KM-Practices (25 suppliers) emerges that only 11 out of 61 suppliers are efficient and effective

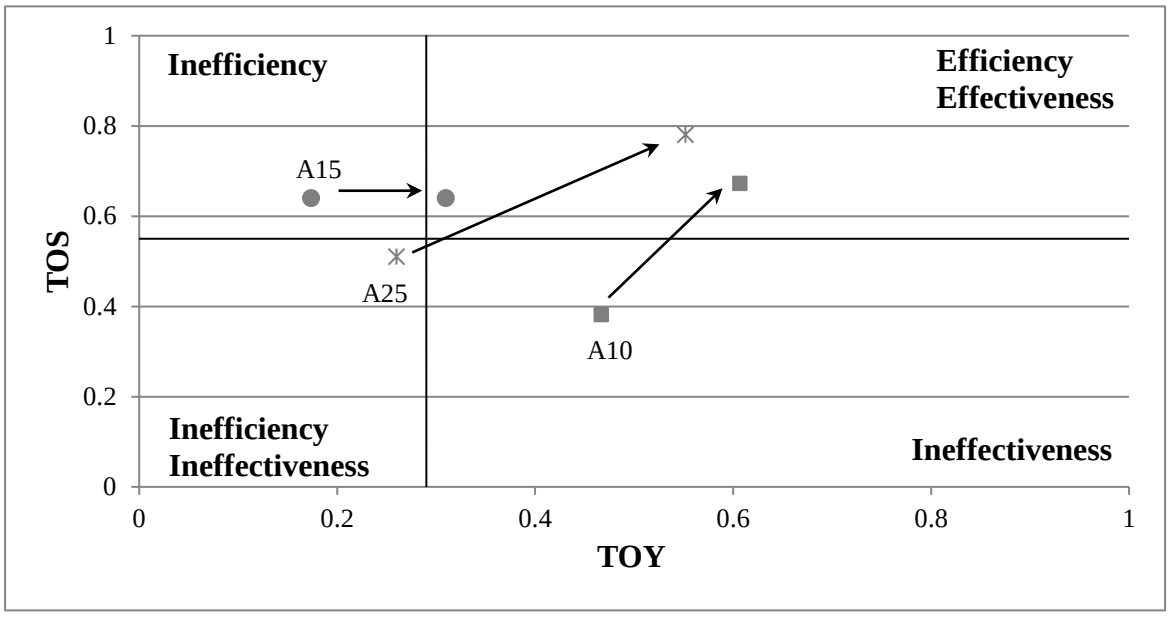
for both KM-Tools and KM-Practices.
Given this scenario, Figure 8 and Figure 9 reveal operative taxonomies which may be used to identify the specific strengths and weaknesses of an individual supplier and to suggest appropriate changes to improve the degree of efficiency and effectiveness of KMSs in relation to its knowledge (Figure 10a and Figure 10b).

As for KM-Tools, Figure 10a shows that supplier A15 is located in the *area of inefficiency* (top left area) and has a low percentage of KM-Tools intersecting with the supplier's knowledge, but a high percentage of knowledge covered by appropriate KM-Tools (TOY=0.17; TOS=0.64). This means that this supplier uses KM-Tools that are not aligned with the supplier's knowledge. This supplier could improve its position and shift towards the *area of efficiency and effectiveness* (top right area), thus increasing the degree of efficiency. This may be achieved by reducing the KM-Tools that do not cover the supplier's knowledge, e.g. *Cloud Computing, Peer-to-Peer Resource Sharing, Audio and Video conference* and *Content Management System* (TOY=0.31; TOS=0.64).

Supplier A10, situated in the *area of ineffectiveness* (bottom right area in Figure 10a) has a high percentage of KM-Tools intersecting with the supplier's knowledge, but a low percentage of its knowledge is covered by appropriate KM-Tools (TOY=0.47; TOS=0.38). This supplier should improve its position by shifting towards the *area of efficiency and effectiveness* (top right area), significantly increasing the level of effectiveness by adopting even just one KM-Tool (*Cloud Computing*) to cover one of the supplier's knowledge macro-areas (TOY=0.61; TOS=0.67).

Suppliers located in *the area of inefficiency and ineffectiveness* (low-left area in Figure 10a) have a low percentage of KM-Tools intersecting with their knowledge, and a low percentage of knowledge is covered by appropriate KM-Tools. These suppliers should improve their position by shifting towards the *area of efficiency and effectiveness* (top right area), thus increasing both efficiency and effectiveness levels.
For example, supplier A25 is located in the area with inefficient and ineffective KM-Tools (TOY=0.26, TOS=0.51), so to shift towards the *area of efficiency and effectiveness* it would be necessary to introduce and, at the same time, exclude certain KM-Tools. More specifically, the supplier may consider adopting the *Business Process Management System*, a KM-Tool aligned with the nature of its knowledge rather than *Peer-to-Peer Resource Sharing, Audio and Video Conference*, *Document Management System*, and *Content Management System*, which do not cover the supplier's knowledge (TOY=0.55, TOS=0.78).
As for KM-Practices, Figure 10b shows that supplier A39 is located in the area of inefficiency (top left area) (PRY=0.22; PRS=0.78). To improve its effectiveness, it has to consider that some of its KM-Practices (i.e. *Knowledge Filtering, Benchmarking, Knowledge Mapping,* and *Communities of Practices*) are not suitable to cover the nature of its knowledge. Excluding these practices will therefore improve this supplier's efficiency and effectiveness indices (PRY=0.40; PRS=0.78).
Supplier A43 (bottom right area in Figure 10b) is located in the area of ineffectiveness (PRY=0.36; PRS=0.51) and it should adopt additional KM-Practices (such as *Lesson Learned* and *Balance Scorecard*) based on the nature of its knowledge in order to improve its effectiveness (PRY=0.47; PRS=0.81).

(a)



(b)

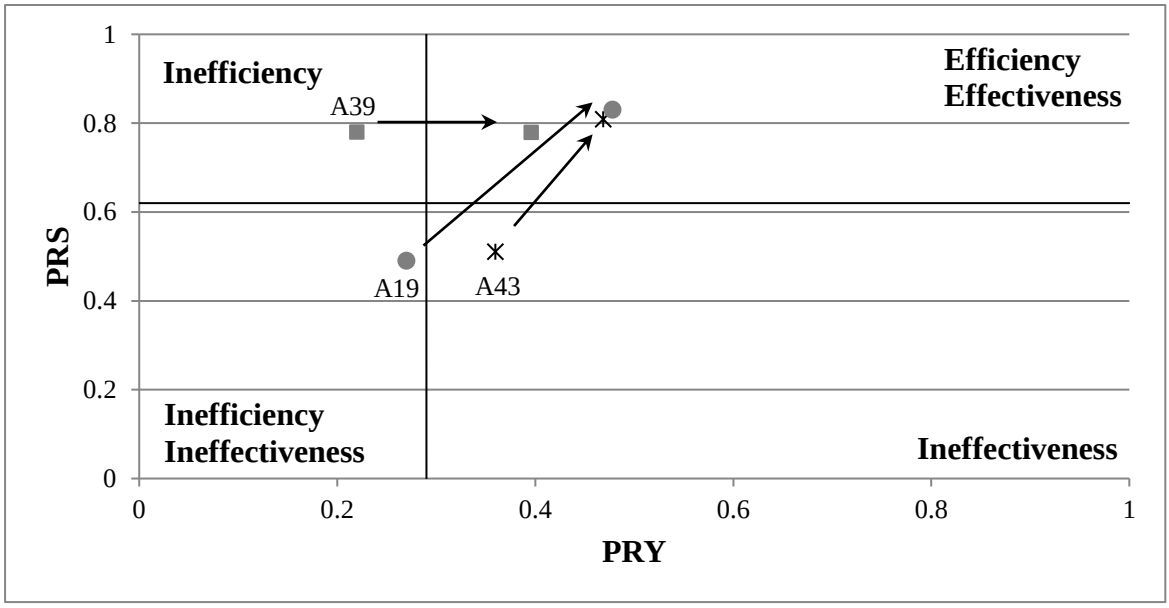


Figure 10. Taxonomy of the efficiency and effectiveness of KM-Tools in relation to a supplier's knowledge (a) and KM-Practices in relation to a supplier's knowledge (b)

The last condition to investigate is that of the suppliers located in the bottom left area in Figure 10b. These adopt inefficient and ineffective KM-Practices. By way of example, the supplier labelled A19 (PRY=0.27; PRS=0.49) should consider abandoning some of its KM-Practices (*Meeting/Task Force* and *Communities of Practice*) and implementing some different ones (*Best Practice, Lesson Learned* and *Balance Scorecard*), better able to cover its knowledge and lead to

improved efficiency and, at the same time, effectiveness (PRY=0.48; PRS=0.83).

5. Conclusions and implications

In this paper, a methodology based on 3D fuzzy logic has been proposed to answer our research question assessing the level of efficiency and effectiveness of KMSs in relation to the supplier's knowledge.
In this paper the knowledge management systems identified were divided into two groups: knowledge management practices (KM-Practices), namely methods and techniques to support the processes of knowledge management, and knowledge management tools (KM-Tools), i.e. the specific IT-based systems supporting KM methods and techniques.
Two pairs of indices are proposed in order to identify the level of efficiency and effectiveness of knowledge management systems in relation to a supplier's knowledge. The first pair of indices assesses the degree of efficiency and the degree of effectiveness of KM-Tools. The second measures the degrees of efficiency and effectiveness of KM-Practices.
Starting from these indices of efficiency and effectiveness, a taxonomy able to encompass the possible typologies of suppliers was established. Specifically, four typologies of suppliers were identified: efficient and effective suppliers, inefficient suppliers, ineffective suppliers, and inefficient and ineffective suppliers.
The proposed methodology was implemented in a field analysis based on semi-structured face-to-face interviews that involved a sample of sixty-one suppliers operating as suppliers in high-tech and/or complex industries.

Implications
Starting from these conclusions, it is possible to outline some managerial and policy implications. Firstly, the paper shows that only 18% of surveyed suppliers (11 out of 61) are completely in the area of efficiency and effectiveness for both KM-Tools and KM-Practices. 82% of surveyed suppliers are inefficient and/or ineffective for at least one of the two components of KMSs (KM-Tools or KM-Practices).
Secondly, the paper evidences that suppliers adopt a large variety of KM-Tools and KM-Practices to support the process of knowledge management. It seems to be of less concern that suppliers have scarce human and financial resources to invest in the area of knowledge management. This could be the result of the process of innovation in the field of information and communication technologies (ICTs) that are increasingly offering suppliers new low-cost opportunities (not requiring significant financial investments) and ease-of-use (needing no specific skills). But if the human and financial barriers that hinder suppliers in improving the process of KM are weakened, what then is the problem? The results of this paper suggest that the problem lies in the misalignment of the supplier's knowledge with the KMSs adopted. In the end, the problem does not lie in difficulties in investing in human and financial resources, but in the ability to invest in the specific KMSs better able to support the KM process.
From this point of view, the methodology proposed in this paper offers an operative tool that may be used by both suppliers and policy makers to support the decision-making aimed to suggest changes able to increase the efficiency and effectiveness of a supplier supporting its knowledge management process.
Finally, the proposed methodology provides an operational tool for both suppliers and policy makers.
Concerning the suppliers themselves, the proposed methodology may be used as a decision-

making tool to suggest suitable changes in the adoption of KM-Tools and KM-Practices in order to increase the level of alignment with knowledge and thus improve the process of knowledge management.
For policy makers, however, the methodology proposed here may be of help in identifying the weaknesses of the suppliers and identifying specific policies to support the competitiveness of supply systems by improving their management processes and the circulation of knowledge among suppliers.

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The spread of environmental sustainability in logistics service providers: A cross-country investigation in Europe

Abstract

This paper provides an overview on emerging green practices and technological systems adopted by logistics service providers (LSPs). On the basis of a literature review on the topic, two research questions were identified and addressed through a literature review on the topic and a cross-country analysis conducted in a sample of 402 Italian LSPs, 304 British LSPs, and 295 German LSPs. The first research question regards a taxonomy of green practices and technological systems that could be adopted by LSPs. The second research question concerns the degree of adoption of green practices and technological systems.

Keywords - cross-country analysis; logistics service industry; sustainable supply chain

Introduction

In the last few years, there was an increasing number of papers dealing with the topic of environmental sustainability in logistics industry (Seuring and Müller, 2008; Vachon and Klassen, 2008) due to the growing number of environmental requirements established by the climate change agreements (Kyoto Protocol, 1998; Copenhagen Accord, 2009; Doha Amendment, 2012; Paris Agreement, 2015). Nevertheless, this literature focuses mainly on green initiatives adopted by large manufacturing firms (Dao et al., 2011; Park et al., 2010; Ranganathan et al., 2011; Wang et al., 2015; Whinkler, 2011), whereas in the field of logistics service providers (LSPs) there is not yet a structured framework (Centobelli et al., 2017; Maas et al., 2012; Zailani et al. 2011). This issue is crucial since the adoption of green initiatives by LSPs could play a pivotal role towards the achievement of environmental sustainability strategies affecting the entire supply chain. In addition, in the literature there is not a shared definition of green initiatives, but there is a variety of definitions that converges into two main definitions according to an organisational and a technological perspective: 1) green practices to achieve the green aims through organisational methods or techniques (Lieb and Lieb, 2010; Perotti et al., 2012; Pieters et al., 2012); 2) technological systems supporting the green practices (Iacob et al., 2013; Kang et al., 2013; Loebbecke and Powell, 1998).

The literature on the topic identifies specific green practices to support the adoption of environmental sustainability strategies and achieve the green aims (e.g. alternative fuels, alternative vehicles, alternative transportation modes) and proposes specific technological systems to support the green practices (e.g. GPS applications, warehouse management systems, environmental database systems, expert systems). Nevertheless, the literature does not offer an exhaustive framework of the whole set of green initiatives including comprehensively the emerging green practices and the emerging technological systems that could be adopted by LSPs. In addition, the literature deals with green initiatives adopted by LSPs, but not focuses on LSPs that adopt green initiatives. This means that from the literature does not emerge the perspective of individual LSPs. In other words, the literature does not show out the degree of adoption of green initiatives by the individual logistics service provider. Furthermore, it does not emerge if there is a relationship between the diffusion of green practices and the adoption of technological systems by LSPs. These topic areas are particularly important as logistics service providers are not entities without an own strategy to deal with the environmental sustainability.

This literature gaps are also heightened by the scarcity of empirical papers on the topic. Starting from these gaps our paper identifies two research questions (RQs) regarding: (1) the

proposal of a taxonomy of emerging green initiatives that could be adopted by LSPs and (2) the relationship between the degree of adoption of green practices and technological systems adopted by European LSPs. The proposed RQs are addressed through a cross-country analysis conducted in a sample of 402 Italian LSPs, 304 British LSPs, and 295 German LSPs.
The paper is structured in six sections. After the introduction, in the second section the framework is described. The methodology is analysed in the third section. In the fourth section the context of investigation is presented. The main findings of field analysis are illustrated in the fifth section. Finally, conclusions and implications are discussed in the sixth section.

Framework

Starting from the different definitions of green initiatives analysed in the introduction (Iacob et al., 2013; Kang et al., 2013; Lieb and Lieb, 2010; Maas et al., 2012; Perotti et al., 2012; Pieters et al., 2012), Centobelli et al. (2017) proposed a novel definition of green initiative and developed a framework aimed to integrate the concepts of green aims towards the achievement of environmental sustainability strategies, green practices, namely the set of specific organisational techniques and methods to achieve the green aims, and technological systems, defined as the IT-based systems supporting green practices. Therefore, a green initiative may be defined as a set of aims (managerial perspective), green practices (organisational perspective) and technological systems (technological perspective) supporting LSPs to achieve their environmental sustainability strategies (Figure 1).
Starting from the proposed conceptualization, a literature review on the adoption of green initiatives in freight transportation and logistics service industry was conducted to provide a taxonomy of LSP green practices (Table 1) and a taxonomy of LSP technological systems (Table 2) supporting an LSP green aim.

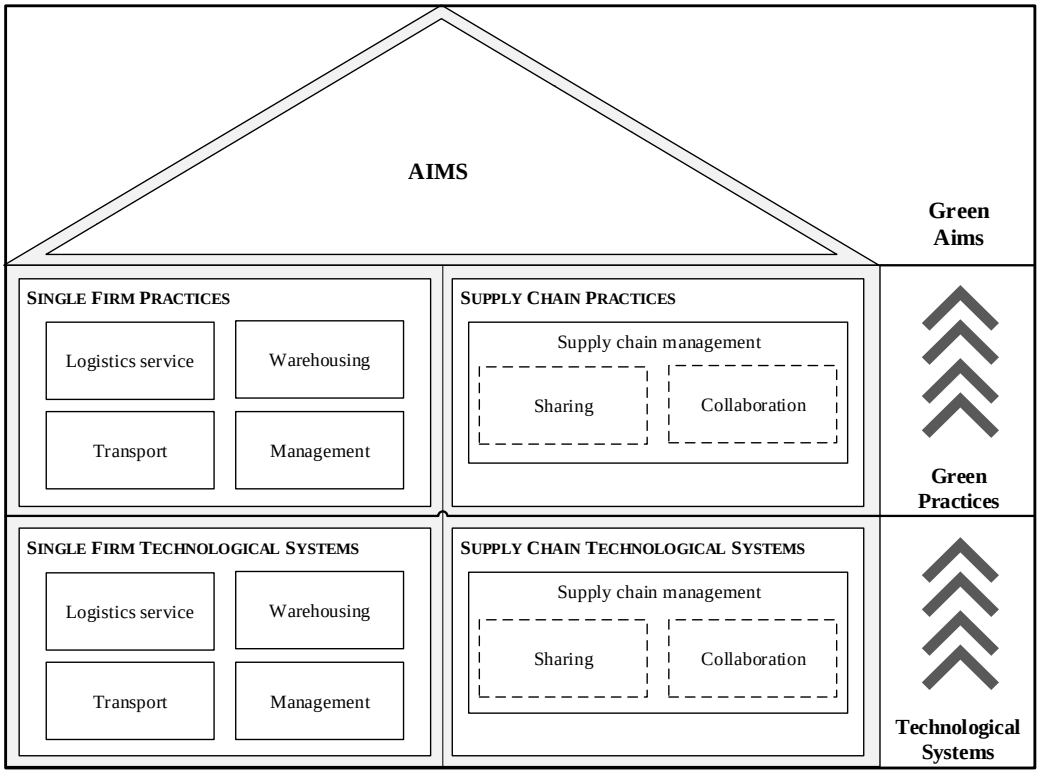

Figure 1. Conceptualization of green initiative

Table 1. Taxonomy of LSP green practices

Typology	Phase of the service	Practice	References
Single-firm practices	Transport	Alternative fuels	Browne et al. (2012); Ciliberti et al. (2008); Colicchia et al. (2013); Facanha and Horvath (2005); Isaksson and Huge-Brodin (2013); Lieb and Lieb (2010); Perotti et al. (2012); Pieters et al. (2012)
		Alternative transportation modes	Ciliberti et al. (2008); Colicchia et al. (2013); Facanha and Horvath (2005); Isaksson and Huge-Brodin (2013); Lammgard (2012); Lieb and Lieb (2010); McIntyre et al. (1998a, b); Mondragon et al. (2009); Perotti et al. (2012); Pieters et al. (2012); Rondinelli and Berry (2000)
		Alternative vehicles	Gonzalez-Benito and Gonzalez-Benito (2006); Jumadi and Zailani (2010); Lieb and Lieb (2008); Pieters et al. (2012)
		Eco-driving	Hervani et al. (2005); Lieb and Lieb (2010); Lin and Ho (2008); Murphy and Poist (2000); Tsoulfas and Pappis (2008)
		Empty running	Pieters et al. (2012), McKinnon (2007)
		Full vehicle loading	Ciliberti et al. (2008); Colicchia et al. (2013); Faruk et al. (2001); Gonzalez-Benito and Gonzalez-Benito (2006); Lammgard (2012); Lieb and Lieb (2010); Perotti et al. (2012); Rondinelli and Berry (2000)
		Routing techniques to minimise travel distances	Colicchia et al. (2013); Hilty et al. (2006); Jeffers (2010); Jumadi and Zailani (2010); Lammgard (2012); Lieb and Lieb (2008, 2010); Lin and Ho (2008); Perotti et al. (2012)
	Warehousing	Alternative energy sources	Ciliberti et al. (2008); Colicchia et al. (2013); Hervani et al. (2005); Lieb and Lieb (2010); Murphy and Poist (2000); Pieters et al. (2012); Rondinelli and Berry (2000); Zhu and Sarkis (2007)
		Energy-efficient warehousing	Ciliberti et al. (2008); Hervani et al. (2005); Lieb and Lieb (2010); Lin and Ho (2008); Murphy and Poist (2000); Zhu and Sarkis (2007)
	Logistics service	Materials recycling	Colicchia et al. (2013); Hervani et al. (2005); Jumadi and Zailani (2010); Lieb and Lieb (2010); Murphy and Poist (2000); Rondinelli and Berry (2000); Tsoulfas and Pappis (2008)
		Packaging recycling	Ciliberti et al. (2008); Colicchia et al. (2013); Gonzalez-Benito and Gonzalez-Benito (2006); Jumadi and Zailani (2010); Lieb and Lieb (2010); Murphy and Poist (2000); Perotti et al. (2012); Pieters et al. (2012); Rondinelli and Berry (2000); Tsoulfas and Pappis (2008)
	Management	Certification (ISO 14001)	Facanha and Horvath (2005); Lammgard (2012); Pieters et al. (2012); Rondinelli and Berry (2000)
		Employee training	Colicchia et al. (2013); Murphy and Poist (2000); Lammgard (2012); Lieb and Lieb (2008, 2010); Perotti et al. (2012); Rondinelli and Berry (2000)
		Environmental performance measurement and monitoring	Darnall et al. (2009); Hervani et al. (2005); Lieb and Lieb (2008); Tsoulfas and Pappis (2008); Wever et al. (2007)
Supply chain practices	Management	Coordinated logistics and transportation programs	Efendigil et al. (2008); Jumadi and Zailani (2010); Krumwiede and Sheu (2002); Lai et al. (2010); Lieb and Lieb (2010); Meade and Sarkis (2002); Min and Ko (2007); Tsoulfas and Pappis (2008)
		Coordinated certification programs and green goals	Lieb and Lieb (2010)
		Spread of information on carbon footprint	Lieb and Lieb (2010); Lammgard (2012); Pieters et al. (2012)
		Collaboration with customers	Colicchia et al. (2013); Efendigil et al. (2008); Isaksson and Huge-Brodin (2013); Jumadi and Zailani (2010); Lai et al. (2010); Krumwiede and Sheu (2002); Lammgard (2012); Meade and Sarkis (2002); Min and Ko (2007); Tsoulfas and Pappis (2008); (2010); Perotti et al. (2012); Pieters et al. (2012)
		Collaboration with other LSPs	Colicchia et al. (2013); Isaksson and Huge-Brodin (2013); Lieb and Lieb (2010); Pieters et al. (2012)
		Spread of information on greenhouse gas goals	Lammgard (2012); Lieb and Lieb (2010)

Table 2. Taxonomy of LSP technological systems

Typology	Phase of the service	System	References
Single-firm systems	Transport	Emission control systems	De Gennaro et al. (2016); Iacob et al. (2013); Millstein and Harley (2010)
		GPS applications	Bolbol et al. (2012); Dare and Saleh (2000); Feng and Timmermans (2013); Mazloumi et al. (2010); Ota et al. (2001); Wang et al. (2008); Zheng et al. (2010)
	Warehousing	Real-time locating	Choi et al. (2012); Jiang et al. (2015); Kang et al. (2013); Leon

		systems	(2014); Periša et al. (2015)
		Warehouse management systems	Chiang et al. (2011); Ruiz et al. (2011); Shiau and Lee (2010); Smith (2011); Wang et al. (2010)
	Logistics service	Logistics management systems	Cho et al. (2006); Helo et al. (2006); Huang et al. (2001); Prasanna and Hemalatha (2012); Prindezis and Kiranoudis (2005)
		Material management systems	Castro-Lacouture and Skibniewski (2003); Elzarka and Bell (1995); Mohanty and Deshmukh (2001); Polat and Arditi (2005)
	Management	Environmental database systems	Georgakaki et al. (2002); Georgakaki et al. (2003); Giannouli et al. (2006); Kalivoda, and Kudrna (2002); Keller al. (2002); Samaras (2002)
		Environmental management systems	Celik (2009); González et al. (2006); Halkos and Evangelinos (2002); Prajogo et al. (2014)
		Enterprise resource planning (ERP)	Ho (2007); Huanhuan et al. (2013); Parry and Graves (2008); Ski and Fajfer (2011); Toloie-Eshlaghi et al. (2011)
		Expert systems	Abacoumkin and Ballis (2004); Chan et al. (2001); Chou (2009); Fedra and Winkelbauer (2002); Mellado et al. (1999); Tuma et al. (1996)
		Learning management systems	Avgeriou et al. (2003); Grace and Butler (2005); Kritikou et al. (2008); Lonn and Teasley (2009); McGill and Klobas (2009)
		Order management systems	Balve et al. (2001); Meyer (2009); Wei and Ma (2014)
Supply chain systems	Management	Cloud computing	Chen et al. (2014); Li et al. (2011); Li et al. (2012); Qin and Zhao (2012); Subramanian et al. (2014); Wang and Shen (2011); Xie (2012)
		Collaborative systems	Chandra and Kumar (2001); Giuli et al. (2013); Sheu et al. (2006)
		Content management systems	Burzagli et al. (2004); Ziep et al. (2009)
		Customer relationship management systems	Burzagli et al. (2004); Ziep et al. (2009)
		Email	Coussement and Van den Poel (2008, 2009); Laclavík et al. (2011)
		Environmental apps	Fligor (2010); Galster (2013); Ibekwe et al. (2016); Kardous and Shaw (2013, 2014); Nast et al. (2014)
		Mash-up	McManus (2008); Severance et al. (2008); Shiga (2007); Stock (2007)
		Peer-to-peer (P2P) resource sharing	Damiani et al. (2006); Ma et al. (2006); Marti and Garcia-Molina (2006); Song et al. (2005); Zhang et al. (2013); Zhao et al. (2011)
		Social media	Fisher et al. (2014); Gal-Tzur et al. (2014); Grant-Muller et al. (2015); Pender et al. (2014); Wamba and Carter (2014)
		Syndication systems	Johnson et al. (2009); Niu et al. (2012); Ovadia (2012)
		Videocasting	Bonsón and Bednárová (2015); Cheng et al. (2013); Tao et al. (2012); Wu et al. (2014)
		Wiki	Elgort et al. (2008); Prasarnphanich and Wagner (2011); Ruth and Houghton (2009); Trentin (2009); Wagner and Majchrzak (2006)

As for LSP green practices, two main categories of practices have been identified in the body of literature, i.e. single-firm practices and supply chain practices. Furthermore, according to the specific service provided, single-firm practices are divided into four sub-categories: transport practices (alternative fuels, alternative transportation modes, alternative vehicles, eco-driving, empty running, full vehicle loading, routing techniques to minimise travel distances), warehousing practices (alternative energy sources, energy-efficient warehousing), logistics service practices (materials recycling and packaging recycling), and management practices (certification ISO 14001, employee training, environmental performance measurement and monitoring).

With regard to LSP supply chain practices, i.e. the set of green practices requiring the involvement of partners, they are all categorised into management practices. This last category includes both sharing practices (i.e., spreading information on the carbon footprint, spreading information on greenhouse gas goals) and collaboration practices (i.e., coordinated logistics and transportation programs, coordinated certification programs and green goals, collaboration with customers, collaboration with other LSPs).

To support the above-mentioned green practices, the literature identifies two main categories of LSP technological systems that can be adopted: single-firm systems and supply chain systems. This taxonomy (Table 2) presents a similar classification (i.e. single-firm systems,

supply chain systems) and the same service categories as the taxonomy used for LSP green practices: transport systems (emission control systems, GPS applications), warehousing systems (real-time locating systems, warehouse management systems), logistics service systems (logistics management systems, material management systems), and management systems (environmental database systems, environmental management systems, enterprise resource planning - ERP, expert systems, learning management systems, order management systems). All the systems regarding the supply chain are categorised into management systems and, also in this case, supply chain systems include sharing technologies (i.e., content management systems, environmental apps, mash-up, syndication system, and videocasting) as well as collaboration technologies (i.e., cloud computing, collaborative system, customer relationship management systems, email, P2P resource sharing, social media, wiki).
These two taxonomies presented above allow us to provide an answer to the *RQ1*. They also offer an overview of the set of green practices and technological systems supporting LSPs in the process of adoption of environmental sustainability towards the achievement of their green aims. Based on these taxonomies identified on the basis of the literature review, the following two sections highlight the methodological steps and the investigative context of the research process in order to provide an answer to the *RQ2*.

Methodology

A web-based document analysis methodology has been used to investigate the degree of adoption of green practices and technological systems in a sample of European LSPs.
The web-based document analysis was carried out from May 2015 until July 2017. As the web is becoming a critical tool for the dissemination of ES strategies (Coope, 2004; Guziana, 2011) there is a growing amount of research based on communication of environmental issues on the web (Eyun-Jung and Childers, 2006; Chaudhri and Wang, 2007; Greer and Moreland, 2007; Guimarães-Costa and Pe, 2008; Sones et al., 2009; Tagesson et al., 2009). The research conducted among the LSPs is based on a systematic approach. A comprehensive review and content analysis was carried out using the information available on the websites of the firms analysed. In order to have a more comprehensive picture of each individual LSP investigated, information from additional sources (e.g. LSP environmental reporting, industry reports, industry magazines) were collected and analysed. The websites and the complementary sources were analysed for the presence of information related to the environment included in the above-mentioned taxonomy, such as adopting a specific green practice (e.g. environmental performance measurement and monitoring, routing techniques to minimise travel distances) or a specific technological system (e.g. environmental management systems, real-time locating systems, emission control systems).
The web-based document analysis has been conducted through the following six steps:

1) *Document search* (Labuschagne, 2003; Zhang and Wildemuth, 2005), in which LSP websites and other relevant sources (e.g. LSP environmental reporting, industry reports, industry magazines) are identified using key words in various search engines, websites and databases
2) *Document selection* (Labuschagne, 2003; Zhang and Wildemuth, 2005), in which the materials of interest are selected in parallel by two researchers and collected in a document management systems including a folder for each LSP
3) *Manual analysis* (Hsieh and Shannon, 2005; Bowen, 2009), in which the two researchers have conducted the conventional analysis described by Hsieh and Shannon (2005) to analyse in-depth the materials of interest selected. In this phase a database has been created to identify for each firm a preliminary list of individual aims, practices and technological systems adopted.

4) *Computer-assisted analysis* (Laender et al., 2002; Zhang and Wildemuth, 2005), in which each material of interest is further analysed using NVivo[1] software to code frequency of keywords represented by the individual items included in the taxonomies identified in section 3 by cross-examining information using query functions for web mining and knowledge discovery.
5) *Confirmation analysis* (Angers and Machtmes, 2005; Bowen, 2009), in which the triangulated findings are confirmed and/or supplemented by an interview carried out by telephone or videoconference to ensure the reliability of results.
6) *Triangulation of findings* (Patton, 1990; Eisner, 1991; Angers and Machtmes, 2005; Bowen, 2009), in which the results provided by manual analysis (step 3), computer-assisted analysis (step 4), and confirmation analysis (step 5) are validated through cross verification.

Context of investigation

Starting from the methodological premises illustrated above, the empirical analysis was carried out on a sample of 1275 LSPs belonging to three different European countries (Germany, Italy, United Kingdom). The selected LSPs meet the following four criteria (Zhu et al., 2007; Colicchia et al., 2013): 1) micro-, small-, medium- or large-sized firms, with their headquarters, or at least a branch, in Germany, Italy or United Kingdom; 2) firms that operate in different supply chains; 3) samples of firms that represent the population of LSPs operating the country investigated; and 4) firms that communicate their environmental sustainability strategies to their stakeholders on their websites or on environmental reports.

Germany

In Germany, the analysis was carried out on a sample of 295 out of 798 LSPs listed in *Bundesvereinigung Logistik (BVL). BVL*, founded in 1978, involves companies and individuals from the worlds of industry, commerce, services and science who are actively involved in the business of logistics and supply chain management.
The sample mainly comprises medium and large enterprises (SMEs) as shown in table 3. For this table, the latest definition of SMEs proposed by the EU Commission is used (European Commission, 2005). Table 3 also highlights that 45.4% of LSPs has a core business in transport, 28.5% in value added logistics services, 11.9% in distribution, and 14.2% in warehousing.

Table 3. Breakdown of the German LSPs investigated

CONTEXT OF INVESTIGATION		Number of LSPs	%
Employee band	Micro (0-9)	25	8.5
	Small (10-49)	73	24.7
	Medium (50-249)	92	31.2
	Large (>250)	105	35.6
Industry	Transport	134	45.4
	Logistics Services	84	28.5
	Distribution	35	11.9
	Warehousing	42	14.2

Italy

The analysis has been conducted in a sample of 402 LSPs listed in *Confederazione Generale Italiana dei Trasporti e della Logistica (Confetra)*, the largest Italian association of firms operating in the logistics service and freight transportation industry. *Confetra*, founded in

[1] http://www.qsrinternational.com/products_nvivo.aspx

1946, currently comprises 544 LSPs and carry out a number of activities to support the associated firms. The analysis was carried out on a sample of 402 out of 544 LSPs listed in *Confetra* achieving a response rate of 73.9%. The sample mainly comprises small and medium enterprises (SMEs) as shown in table 4. Turnover varies from 9 to 1,500 million euros.

Table 4. Breakdown of the Italian LSPs investigated

CONTEXT OF INVESTIGATION		Number of LSPs	%
Employee band	Micro (0-9)	2	0.5
	Small (10-49)	138	34.2
	Medium (50-249)	207	51.6
	Large (>250)	55	13.7
Industry	Transport	216	53.6
	Logistics services	104	25.8
	Distribution	73	18.4
	Warehousing	9	2.2
Total		**402 LSPs**	

Table 4 highlights also that the majority of LSPs (53,6%) has a core business on transport, 25.8% on value added logistics services, 18.4% on distribution, and 2.2% on warehousing.

United Kingdom

In the United Kingdom, the survey analysis was carried out on a sample of 304 out of 578 LSPs listed in *British International Freight Association* (*BIFA)*, achieving a response rate of 52.6%. *BIFA* is the national association for UK-registered companies engaged in international movement of freight by all modes of transport, air, road, rail and sea. Table 5 highlights that 39.5% of LSPs has a core business in transport, 32.6% in value added logistics services, 17.8% in distribution, and 10.1% in warehousing.

Table 5. Breakdown of the British LSPs investigated

CONTEXT OF INVESTIGATION		Number of LSPs	%
Employee band	Micro (0-9)	44	14.5
	Small (10-49)	93	30.6
	Medium (50-249)	101	33.2
	Large (>250)	66	21.7
Industry	Transport	120	39.5
	Logistics Services	99	32.6
	Distribution	54	17.8
	Warehousing	31	10.1

On the basis of these contextual premises, the results of the empirical analysis will be presented in the next section.

Results

This section is divided into four parts and presents the main findings of the empirical analysis to identify the degree of adoption of green practices and technological systems by the European LSPs investigated. The first three parts analyse respectively the main results regarding the diffusion in Germany, Italy and UK. The fourth carries out a comparison among the different countries.

Diffusion of LSP green practices and technological systems in Germany

The degree of adoption of green practices (technological systems) was defined as the number of LSPs adopting the specific green practice (technological system) divided by the total number LSPs of the sample (295). It shows the percentage of LSPs using a specific green practice (technological system). The degree of adoption ranges from zero, if no LSP uses the specific green practice (technological system) to 100, if all the LSPs use the specific green practice (technological system).

Analysing each of the categories reported in the proposed taxonomies of LSP green practices and technological systems (Table 1 and Table 2), the following three points summarise the main findings of this research in German LSPs:

1. regarding the typology of green initiative, i.e. single-firm initiatives vs supply chain initiatives, the number of logistics service providers adopting at least one of the single-firm practices or one of the single-firm technological systems (294) are always higher than those adopting at least one of the corresponding practices involving supply chain partners (205).
2. as for green practices vs technological systems results, the number of LSPs adopting at least one single-firm practice/supply chain practice (285) is always lower than those adopting at least one of the corresponding single-firm technological systems/supply chain technological systems (295);
3. as for the different phases of the service (i.e. transport, warehousing, logistics services, and management), the difference between the number of LSPs adopting at least one green practice from each category and those adopting the entire set of green practices (285) is always lower than the difference between the number of LSPs adopting at least one and those adopting all technological systems (295).

Diffusion of LSP green practices and technological systems in Italy

As for the degree of adoption of green practices and technological systems in Italian LSPs, the following points summarise the main findings the main findings of this research:

1. regarding the typology of LSP green initiative, i.e. single-firm initiatives vs supply chain initiatives, the number of logistics service providers adopting at least one of the single-firm green practices or one of the single-firm technological systems (367 LSPs) are always lower than those adopting at least one of the corresponding practices or systems involving supply chain partners (399 LSPs);
2. as for green practices vs technological systems results, the number of LSPs adopting at least one single-firm practice/supply chain practice (284) is always lower than those adopting at least one of the corresponding single-firm technological systems/supply chain technological systems (401).
3. as for the different phases of the service (i.e. transport, warehousing, logistics services, and management), the difference between the number of LSPs adopting at least one green practice from each category and those adopting the entire set of green practices (283) is always lower than the difference between the number of LSPs adopting at least one and those adopting all technological systems (401).

Diffusion of LSP green practices and technological systems in United Kingdom

Concerning the degree of adoption of green practices and technological systems adopted by LSP operating in UK, the following three points summarise the main findings:

1. regarding the typology of green initiative, the number of logistics service providers adopting at least one of the single-firm practices or one of the single-firm technological systems (289) are always higher than those adopting at least one of the corresponding practices involving supply chain partners (192).

2. as for green practices vs technological systems results, the number of LSPs adopting at least one single-firm practice/supply chain practice (295) is always lower than those adopting at least one of the corresponding single-firm technological systems/supply chain technological systems (304).
3. as for the different phases of the service (i.e. transport, warehousing, logistics services, and management), the difference between the number of LSPs adopting at least one green practice from each category and those adopting the entire set of green practices (295) is always lower than the difference between the number of LSPs adopting at least one and those adopting all technological systems (304).

Cross-country analysis

This section aims to carry out a comparison between surveyed LSPs operating in Germany, Italy and United Kingdom concerning the degree of adoption of green practices and technological systems. This is subdivided into two parts. The first part deals with a cross-country analysis on green practices, the second part focuses on technological systems.

Green practices

This paragraph presents a comparison between LSPs operating in the three countries investigated concerning the degree of adoption of green practices.

Analysing the degree of adoption of single-firm green practices (Table 6), the following three points summarise the main findings:

- as for Germany, the most widely adopted practices are "routing techniques to minimise travel distances", "packaging recycling", "energy-efficient warehousing" and "materials recycling", whereas less adopted practices are "alternative transportation modes", "alternative vehicles" and "alternative fuels"; German LSPs presents the highest degree of adoption for 7 out of 14 single-firm green practices and never present the lowest degree of adoption for the mentioned practices;
- Italian LSPs present the highest degree of adoption for 2 out of 14 practices, i.e., "alternative transportation modes" and "alternative vehicles", whereas less adopted practices are "alternative fuels", "eco-driving", "alternative energy sources", "materials recycling", and "packaging recycle"; Italian LSPs present the lowest degree of adoption for 12 out of 14 single-firm green practices;
- with regard to the United Kingdom, the most widely adopted single-firm green practices are "materials recycling", "alternative fuels", "certification (ISO 14001)", whereas less adopted practices are "alternative transportation modes" and "alternative vehicles"; LSPs operating in the United Kingdom present the highest degree of adoption for 5 out of 14 single-firm practices (i.e., "alternative fuels", "alternative energy sources", "materials recycling", "certification ISO14001", "environmental performance measurement and monitoring") and the lowest degree of adoption for only 2 practices (i.e., "alternative transportation modes", "alternative vehicles").

Table 6. Comparison concerning the degree of adoption of single-firm green practices

Single-firm green practice	Germany	Italy	UK	Country with the highest %
Alternative fuels	17%	5%	30%	**UK**
Alternative transportation modes	13%	29%	4%	**Italy**
Alternative vehicles	16%	18%	6%	**Italy**
Eco-driving	30%	5%	15%	**Germany**
Empty running	48%	12%	29%	**Germany**
Full vehicle loading	22%	14%	21%	**Germany**
Routing techniques to minimise travel distances	48%	12%	34%	**Germany**
Alternative energy sources	23%	8%	28%	**UK**
Energy-efficient warehousing	34%	10%	20%	**Germany**
Materials recycling	34%	8%	37%	**UK**

Packaging recycling	41%	8%	36%	**Germany**
Certification (ISO 14001)	29%	23%	30%	**UK**
Employee training	28%	13%	14%	**Germany**
Environmental performance measurement and monitoring	24%	12%	29%	**UK**
Mean	29%	13%	24%	
Coefficient of variation	38%	54%	45%	

Concerning supply chain green practices, table 7 shows the following main findings:

- as for Germany, the most widely adopted practices are "collaboration with customers", "coordinated logistics and transportation programs", and "spread of information on carbon footprint", whereas less adopted practices are "coordinated certification programs and green goals" and "spread of information on greenhouse goals". German LSPs presents the highest degree of adoption for 4 out of 6 supply chain green practices and never present the lowest degree of adoption for the mentioned practices;
- considering Italy, the most adopted practice concerns the "spread of information on greenhouse goals", whereas less adopted practices are "spread of information on carbon footprint", "coordinated logistics and transportation programs", "collaboration with customers". Italian LSPs present the highest degree of adoption for 1out of 6 supply chain practices and 5 out of 6 present the lowest degree of adoption.
- with regard to the United Kingdom, the most widely adopted supply chain practices are "collaboration with customers", "coordinated logistics and transportation programs", "spread of information on carbon footprint", and "coordinated certification programs and green goals", whereas less adopted practices are "collaboration with other LSPs" and "spread of information on greenhouse goals"; LSPs operating in the United Kingdom present the highest degree of adoption for 1 out of 6 supply chain green practices (i.e., "coordinated certification programs and green goals") and the lowest degree of adoption for 2 practices (i.e., "collaboration with other LSPs", "spread of information on greenhouse goals").

Table 7. Comparison concerning the degree of adoption of supply chain green practices

Supply chain green practice	Germany	Italy	UK	Country with the highest %
Coordinated logistics and transportation programs	29%	8%	20%	**Germany**
Coordinated certification programs and green goals	11%	9%	13%	**UK**
Spread of information on carbon footprint	25%	7%	16%	**Germany**
Collaboration with customers	32%	8%	23%	**Germany**
Collaboration with other LSPs	16%	10%	10%	**Germany**
Spread of information on greenhouse goals	14%	16%	10%	**Italy**
Mean	21%	10%	15%	
Coefficient of variation	41%	34%	35%	

Therefore, these findings highlight that the European LSPs investigated tend to plan their environmental sustainability strategies without setting in an integrated manner the green practices related to the different typologies of service provided. A focus strategy of LSPs investigated in adopting specific green practices emerges. In fact, apart from a few LSPs, the majority tend to assume a fairly homogeneous behaviour and use a small range of green practices in the different phases of the service. Single-firm green practices are on average more adopted than supply chain green practices (Table 8). Concerning Italy, the green practices with the highest degree of adoption support the phase of management, while the

practices with the lowest degree of adoption support the phases of warehousing and logistics services. On the contrary, as regards the spread in the United Kingdom, the green practices with the highest degree of adoption support logistics services, while the green practices with the lowest percentage support the phase of transport. Finally, the green practices most adopted by German firms support mainly the logistics services provided, while the green practices with the lowest degree of adoption support the phases of transport and management.
In addition, the results of this paper concerning supply chain green practices highlight a fairly homogeneous behaviour of British, German and Italian LSPs. These firms tend to adopt collaborative supply chain practices (e.g., coordinated logistics and transportation programs, collaboration with customers) instead of sharing supply chain practices (e.g., spread of information on carbon footprint, spread of information on greenhouse gas goals);

Table 8. Average percentage of green practices by phase of service

Single-firm green practice	Germany	Italy	UK
Transport	28%	14%	20%
Warehousing	29%	9%	24%
Logistics services	38%	8%	37%
Management	27%	16%	24%

Supply chain green practice	Germany	Italy	UK
Sharing	20%	12%	13%
Collaboration	22%	9%	17%

Technological systems
This paragraph presents a comparison between LSPs operating in the three countries investigated concerning the degree of adoption of green practices.
Analysing the degree of adoption of single-firm technological systems, the following three points summarise the main findings (Table 9):

- as for Germany, the most widely adopted practices are “warehouse management systems”, “GPS applications”, “material management systems”, and “order management systems”, whereas less adopted practices are “expert systems”; Table 9 shows that German LSPs presents the highest degree of adoption for 3 out of 12 single-firm green technological systems and present the lowest degree of adoption only for 1 out of 12 technological systems;
- Italian LSPs present the highest degree of adoption for 2 out of 12 practices, i.e., “logistics management systems” and “emission control systems”, whereas less adopted practices are “learning management systems”, “environmental management systems”, and “real-time locating systems”; Italian LSPs present the lowest degree of adoption for 9 out of 12 single-firm technological systems;
- with regard to the United Kingdom, the most widely adopted single-firm green technological systems are “warehouse management systems”, “material management systems”, and “order management systems”; LSPs operating in the United Kingdom present the highest degree of adoption for 7 out of 12 single-firm technological systems (i.e., “real-time locating systems”, “warehouse management systems”, “material management systems”, “environmental database systems”, “ERP”, “expert systems”, “order management systems) and the lowest degree of adoption for 2 technological systems (i.e., “emission control systems”, “logistics management systems”).

Table 9. Comparison concerning the degree of adoption of single-firm technological systems

Single-firm technological system	Germany	Italy	UK	Country with the highest %

Emission control systems	19%	32%	13%	**Italy**
GPS applications	49%	36%	38%	**Germany**
Real-time locating systems	20%	14%	37%	**UK**
Warehouse management systems	56%	42%	62%	**UK**
Logistics management systems	40%	41%	28%	**Italy**
Material management systems	45%	40%	57%	**UK**
Environmental database systems	17%	16%	18%	**UK**
Environmental management systems	23%	5%	14%	**Germany**
ERP	18%	16%	20%	**UK**
Expert systems	12%	16%	17%	**UK**
Learning management systems	12%	4%	9%	**Germany**
Order management systems	41%	23%	47%	**UK**
Mean	29%	24%	30%	
Coefficient of variation	53%	59%	60%	

Regarding supply chain green practices, Table 10 shows the following main findings:

- as for Germany, the most widely adopted technological systems are "email", "social media", "mash-up", whereas less adopted practices are "syndication systems" and "cloud computing". German LSPs presents the highest degree of adoption for 5 out of 12 supply chain technological systems and present the lowest degree of adoption 3 out of 12 systems (i.e., "syndication systems", "collaborative systems", "customer relationship management systems");
- considering Italy, the most adopted technologies are "email" and "customer relationship management systems", whereas less adopted systems are "cloud computing", environmental apps", "syndication systems", and "wiki". Italian LSPs present the highest degree of adoption for 2 out of 12 supply chain technological systems and 10 out of 12 present the lowest degree of adoption.
- LSPs operating in the United Kingdom present the lowest degree of adoption for 1 out of 6 supply chain green technological systems and the highest degree of adoption for 7 out of 12 technological systems (i.e., cloud computing, "collaborative systems", "content management systems", "mash-up", "social media", "syndication systems", "videocasting").

Table 10. Comparison concerning the degree of adoption of supply chain technological systems

Supply chain technological system	Germany	Italy	UK	Country with the highest %
Cloud computing	10%	2%	15%	**UK**
Collaborative systems	16%	19%	19%	**Italy, UK**
Content management systems	53%	41%	53%	**Germany, UK**
Customer relationship management systems	24%	53%	32%	**Italy**
Email	99%	95%	95%	**Germany**
Environmental apps	15%	7%	11%	**Germany**
Mash-up	75%	64%	85%	**UK**
P2P resource sharing	70%	63%	65%	**Germany**
Social media	82%	33%	92%	**UK**
Syndication systems	7%	7%	10%	**UK**
Videocasting	26%	19%	35%	**UK**
Wiki	13%	7%	10%	**Germany**
Mean	41%	34%	44%	
Coefficient of variation	81%	86%	77%	

These results emphasize that LSPs are not a homogeneous world that makes the same choices without distinction and adopts the same technological solutions, but they tend to adopt a differentiation strategy characterized by a combination of variety of experiences, approaches

and behaviours to support their green practices in order to achieve their green aims. Single-firm technological systems are on average less adopted than supply chain technological systems (Table 11). Concerning the three European countries investigated, the green practices with the highest degree of adoption support the logistics services provided for German and Italian LSPs, and the phase of warehousing for British LSPs. The technological systems with the lowest degree of adoption support the phase of management for British, German and Italian LSPs. As regards the spread of supply chain technological systems, British, German and Italian LSPs tend to assume a fairly homogeneous behaviour and tend to adopt collaborative supply chain technological systems (e.g., customer relationship management systems, P2P resource sharing) instead of sharing supply chain technological systems (e.g., content management systems, environmental apps, syndication systems).

Table 11. Average percentage of technological systems by phase of service

Single-firm technological system	Germany	Italy	UK
Transport	34%	34%	26%
Warehousing	38%	28%	50%
Logistics services	43%	41%	43%
Management	21%	13%	21%

Supply chain technological system	Germany	Italy	UK
Sharing	35%	28%	39%
Collaboration	45%	39%	47%

Moreover, the results of this paper highlight misalignment problems between the diffusion of green practices and technological systems. As for the misalignment between the adoption of a set of green practices and technological systems that are more focused on specific services (e.g. warehousing, logistics services), it underlines that LSPs do not have a not full understanding of their integrated role so as to be able to perform a variety of logistics service activities such as transportation, warehousing, management and other functional activities that constitute a complete service package. Firms providing such services typically have a good understanding of their customers' needs. Concerning the misalignment between the adoption of a set of technological systems higher than green practices, the findings show that LSPs nowadays are technologically prepared for the adoption of green strategies. In fact, logistics service providers already own technological systems before the adoption of ES programs, but they are adopted with other aims in view, and to manage other business processes. Not fully understanding their green initiative adoption processes and consequently how to achieve their green aims leveraging on green practices with the support of technological systems, logistics service providers tend not to exploit the potential of technological assets. Therefore, they are achieving their green goals with an unexploited potential and this is a cultural gap among LSPs.

The above misaligned problems also allow us to identify a managerial gap among LSPs. In fact, considering their role as integrators in the supply chain, they should continuously align not only single-firm initiatives and supply chain initiatives, but also green aims, green practices and technological systems during each of the different phases of the service provided. The results of the empirical analysis enable us to address the *RQ2*.

Conclusions and implications

The main aim of this paper is to contribute to increasing the body of knowledge concerning the diffusion of environmental sustainability in the logistics service industry and provide an answer to two research questions identified. The first concerns a comprehensive taxonomy of green practices and technological systems that could be adopted by LSPs to achieve their

green aims, and the second regards the degree of adoption of green practices and technological systems among European LSPs.

As for the first research question, we proposed a definition of green initiative as a concept which incorporates three different, but complementary perspectives: a managerial perspective (the green aim), an organizational perspective (the green practice), and a technological perspective (the technological system). The green aims are objectives leading to environmental sustainability strategies (e.g. adoption of recycled materials, reduction of oil and other fuels). The green practices are defined as the techniques or organisational methods implemented to achieve the aims (e.g. alternative fuels, alternative vehicles, alternative transportation modes). Finally, technological systems are the specific technologies supporting green practices (e.g. ICTs such as emission control systems, GPS applications, real-time locating systems). Starting from this conceptualization, a literature review on the adoption of green initiatives in freight transportation and logistics service industry was conducted to provide a taxonomy of LSP green practices and a taxonomy of LSP technological systems supporting an LSP green aim. The proposed taxonomies of green practices and technological systems consists of two main types: single-firm practices/technological systems and supply chain practices/technological systems. In addition, in order to focus on the phase of the service affected by the green practice/technological system, single-firm practices/technological systems have been divided into four sub-categories (transport, warehousing, logistics service, management). The two taxonomies are complementary to the previous ones (Lieb and Lieb, 2010a; Pieters et al., 2012; Perotti et al., 2012; Colicchia at al., 2013), insofar as we define a green initiative as a multifaceted concept, and our framework analyses two perspectives at the same time: the typology of initiative and the phase of the service.

With regard to the second research question, a web-based document analysis methodology has been used to investigate the degree of adoption of the green practices and technological systems identified in the taxonomies. The analysis was carried out on a sample of 304 British LSPs, 402 Italian LSPs and 295 German LSPs. This methodology has been conducted through the following six main phases: 1) document search; 2) document selection; 3) manual analysis; 4) computer-assisted analysis; 5) confirmation analysis; and 6) triangulation of findings.

From the point of view of green practices, we found that European LSPs are generally inclined to adopt green practices because of immediate environmental and cost efficiency issues rather than an interest in environmental sustainability issues. Single-firm green practices are on average more adopted than supply chain green practices. Italian LSPs tend to adopt the green practices supporting the phase of management instead of the phases of warehousing and logistics services. On the contrary, British LSPs tend to adopt green practices supporting the logistics services provided, whereas the green practices with the lowest percentage support the phase of transport. German LSPs have a more homogeneous behaviour than the other countries and tend to adopt green practices supporting mainly the logistics services provided. Concerning supply chain green practices, the findings highlight a fairly homogeneous behaviour of British, German and Italian LSPs that adopt collaborative supply chain practices instead of sharing supply chain practices. In summary, the low level of diffusion of green practices shows that the logistics service providers investigated tend to underestimate the competitive potential of environmental sustainability. This aspect is reflected in the adoption of specific single green practice, highlighting the attempt by LSPs to combine management and environmental efficiency without a defined environmental sustainability strategy roadmap. These findings partially confirm, and partially modify, the conclusions of the multiple case study carried out by Colicchia et al. (2013). According to Colicchia et al. (2013) a growing interest has been observed in collaboration with both

customers and suppliers, though they evidence a dearth of effective collaborative actions to improve the environmental sustainability of the supply chain. Contrary to Colicchia et al. (2013), today's results highlight that LSPs have not adopted a large number of green practices. We can note another difference compared with previous results, such as the web survey carried out by Pieters et al. (2012) on 41 Dutch logistics services providers, as it emerges that the LSPs more sensitive to environmental sustainability tend to adopt innovative and optimizing internal green practices in addition to optimizing external green practices. Therefore, they do not seem unaware that cooperation with customers and other LSPs represents a critical and successful factor in achieving green aims.

The results on technological systems highlight that the technological scenario in which LSPs operate has changed in the space of a few years. Technological systems are more commonly adopted than green practices. In fact, in recent years, technology dynamics and innovation have reduced the weight of barriers hindering the adoption of technological systems in the manufacturing and service industries (Cerchione et al., 2015, 2016; Cimoli and Dosi, 1995; Dosi and Labini, 2007). In tune with this rapidly evolving scenario, LSPs keep abreast with technological developments and are able to perceive the strategic value of technological systems, adopting a variety of systems and web-based solutions.

The results of our research highlight that German LSPs have a more homogeneous behaviour than British and Italian LSPs in adopting single-firm technological systems. As for the spread of supply chain technological systems, British LSPs tend to assume a fairly homogeneous behaviour and tend to adopt collaborative supply chain technological systems rather than sharing supply chain technological systems. The findings also highlight that German and Italians LSPs. are more inclined to adopt sharing supply chain systems instead of collaborative supply chain systems. The technological systems with the highest degree of adoption support the logistics services provided for the LSPs operating for German and Italian LSPs and the phase of warehousing for German LSPs. More specifically, Italian LSPs are more inclined to adopt technological systems supporting the phase of logistics services (which is the phase of service with the highest percentage of adoption) than technological systems supporting the phase of management (which is the phase of service with the lowest percentage of adoption). As regards the United Kingdom, the LSPs surveyed are more inclined to adopt technological systems supporting the phase of warehousing (which is the phase of service with the highest percentage of adoption) than technological systems supporting the phase of management (which is the phase of service with the lowest percentage of adoption). German LSPs are more inclined to adopt technological systems supporting the phase of logistics services (which is the phase of service with the highest percentage of adoption) than technological systems supporting the phase of management (which is the phase of service with the lowest percentage of adoption).

Moreover, As regards the spread of supply chain technological systems, British, German and Italian LSPs tend to assume a fairly homogeneous behaviour and tend to adopt collaborative supply chain technological systems (e.g., customer relationship management systems, P2P resource sharing) instead of sharing supply chain technological systems (e.g., content management systems, environmental apps, syndication systems). In fact, although these latter are cheap and easy to use, they are still poorly suited to managing green practices.

This aspect is even more significant considering that LSPs are becoming third-party supply chain management providers (3PSCM), supplying value-added services connected with the production or procurement of goods to customers operating in different complex industries, and tend to adopt the most updated technological systems. The result is a technology gap between the LSP and the customer. To overcome this gap, logistics service providers should exploit the new opportunities provided by ICTs. Consequently, they should dedicate resources who can use the Internet to monitor the technological changes affecting other LSPs and the

evolution of environmental sustainability strategies employed by customers in order to systematically align their single-firm practices with supply chain practices and their single-firm technological systems with supply chain technological systems, as well as to disseminate their best environmental practices online. In summary, despite the clear signs of a focus strategy by the LSPs investigated in adopting green practices, the findings nevertheless emphasize that LSPs do not constitute a homogeneous world making the same choices and adopting the same technological solutions. In reality, they tend to adopt differentiation strategies marked by a combination of their various experiences, approaches and behaviours to support their green practices and achieve their green aims.

Future research and implications

The above conclusions suggest that further research on the topic is needed, and the proposed taxonomies could be applied by an individual LSP as a managerial tool to evaluate and improve the process of adoption of green practices and technological systems. The results of this paper highlight problems of misalignment between the diffusion of green practices and the technological systems used. With particular regard to misalignment between the green practices adopted and the technological systems more focused on specific phases of the service provided, it emerges that LSPs lack a full understanding of their integrated role in performing a variety of logistics service activities such as transportation, warehousing, management and other functional activities making up a total service package. Concerning the misalignment between the adoption of a set of high-level technological systems on the one hand, and the green practices adopted on the other, findings show that LSPs are technologically now well prepared for the possible adoption of green strategies. Logistics service providers already have the technological systems before adopting any environmental sustainability programs, as they are needed for other uses and to manage other business processes. As logistics services providers lack a full understanding of their green initiative adoption processes, they are also uncertain how they may achieve their green aims leveraging on green practices with the support of technological systems, so they tend not to exploit the potential of their existing technological assets. They are therefore achieving their green goals with an unexploited potential, and this represents a cultural gap among LSPs.

The above misalignments also reveal a managerial gap among LSPs. Given their integrating role along the supply chain, they ought to continuously align not only single-firm initiatives and supply chain initiatives, but also green aims, green practices and technological systems at each of the different phases of the service they provide.

The results of this research highlight some implications for further inquiry. A first issue is that the majority of green practices and technological systems present a low degree of adoption. This circumstance requires further and in-depth analysis to investigate the intensity of use of single green practices and technological systems adopted by LSPs. A second factor is that the LSPs surveyed seem to prefer not updated technological systems. This issue requires further and in-depth analysis of the degree of alignment between green practices and technological systems. There is also the need to investigate the alignment between the green practices and technological systems adopted by LSPs and those adopted by their customers. A third research implication concerns the necessity to identify a taxonomy of strategies for adopting green practices and technological systems by logistics service providers. This issue requires an in-depth analysis to verify whether the strategy used affects LSP performance.

From the LSPs' point of view, this paper highlights that they could follow up their environmental sustainability strategies better by exploiting the opportunities offered by the new technological systems (e.g. cloud computing, crowdsourcing systems, collaborative filtering). From the customer's point of view, LSPs may be contracted to perform a specific function or consolidate any number of activities required to satisfy the customer's needs.

Firms that provide such services should typically have a good understanding of their customer's needs and execute services in accordance with contractual documents. To address these needs, this paper stresses that it is necessary to encourage the creation of (even technology-based) direct channels of communication between LSPs and customers. In fact, in many cases LSPs are technologically capable of following their environmental sustainability strategies, and the degree of adoption of technological systems is higher than that of green practices. This means that logistics service providers have not learned their environmental and emerging sustainable practices from customers. In sum, LSPs are pursuing their green aims, but with a scarcity of green practices in contrast with the innovation potential represented by the support that their technological systems could give. Exploiting this innovation potential could allow LSPs to play a critical role in greening the supply chain.

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Examining buyer and user needs for servitized offerings: A survey study

Mehmet Chakkol, Warwick Business School, University of Warwick, Coventry, CV4 7AL, email: Mehmet.Chakkol@wbs.ac.uk

Antonios Karatzas, Norwich Business School, University of East Anglia, Norwich, NR4 7TJ, email: a.karatzas@uea.ac.uk

Jawwad Z. Raja, Copenhagen Business School, Frederiksberg, 2000, Denmark, email: jr.om@cbs.dk

Mark Johnson, Warwick Business School, University of Warwick, Coventry, CV4 7AL, email: mark.johnson@wbs.ac.uk

(Work-in-progress paper)

Abstract

Extant servitization research generally adopts a provider perspective to examine what leads to the effective provision of offerings to satisfy customer needs. The lack of systematic empirical work adopting the perspective of buyers or the users of servitized offerings would suggest that various parameters of the buying decision are poorly understood. Whilst it is acknowledged that servitization entails different types of offerings, the literature does not adequately delineate the operational differences between offering types. We undertook a survey with 325 respondents to uncover the differences in customer needs (i.e., buyers and users), with respect to basic and advanced servitized offerings.

Keywords: servitization, competitive priorities, survey, customer perspective

Introduction

Servitization offers a 'new' means of competitiveness for many in Western economies (Baines et al., 2007; Raja et al., 2018). This has led to numerous scholars discussing the type of capabilities necessary for traditional manufacturing firms to compete in the provision of services and solutions (Gebauer et al., 2011; Sousa and da Silveira, 2017; Kindström et al., 2013). Tuli et al. (2007) pointed to the dominance of the manufacturer's perspective in the extant research, which is at odds with the definition of the concept that is to meet customers' needs. Thus, it is argued that customer factors must be taken into account for the effective delivery and support of servitized offerings (Tuli et al., 2007; Raja et al., 2013). Recent research has started to address the customer perspective, but this tends to ignore the granularity of those who *buy* and those who *use* servitized offerings (Kowalkowski, 2011). Thus, to date, little known about what leads to effective provision of different types of servitized offerings that, in turn, satisfies the needs within the customer organization.

For providers of servitized offerings, understanding customer needs and requirements is fundamental for achieving satisfaction and customer 'lock-in' (Lockett et al., 2011). To this end, the provider can develop capabilities and offerings that match those needs and requirements. Inevitably, this understanding can also impact the design and management of firm-level relationships that can further increase satisfaction (Johnson and Mena, 2008). For example, it is reasonable to expect that the higher the quality of the core product, the more satisfied the customer will be, while it is an almost ubiquitous finding that, in servitized contexts, inter-organisational relationships based on trust and high levels of information exchange are beneficial for both providers and customers (e.g. Karatzas et al., 2016).

However, should one assume that such empirical relationships between provider-specific variables, firm-level relationship dimensions, and customer satisfaction are common across all instances of product-service provision? In other words, are the effects of the various determinants of customer satisfaction the same, irrespective of the type of the customer? For example, customers of product-service offerings may vary in terms of their function; commonly, manufacturers interact with the customer's buying center in the early stages of the offering's life-cycle, but with the actual user when the product is in-service and requires ongoing support. In this regard, assuming that *buyer* and *user* needs differ, Kowalkowski (2011) and Michel et al. (2008) highlight the importance of understanding the perspectives of the different functions inside customer firms. In addition, customers may vary in terms of the offering they are provided with. This offering could range from a simple add-on maintenance agreement, to a sophisticated solution that contractually guarantees certain levels of performance or product availability (Smith et al., 2014). This difference in operational complexity and sophistication places differential weights on different customer needs, suggesting that it could exacerbate or attenuate the effect of the determinants of customer satisfaction.

The departure point of this work is the premise that different customer types place differential importance on the various aspects of the offering and its provider, i.e. they will have varying needs and wants. To this end, we investigate the effects of various buyer-supplier relationship dimensions (e.g. formalization, information exchange) and provider-specific variables (e.g. service orientation, responsiveness, innovation capability) on customer satisfaction with the product-service provider. But more importantly, we examine how these effects vary with the *level of sophistication* of the product-service offering (basic and advanced), and with the *role* of the customer of the offering (buyer versus user). In other words, this research *uncovers the moderating roles of offering type and customer role for customer satisfaction.*

The paper is structured as follows. The next section synthesizes the relevant literature, culminating with the development of two overarching hypotheses. The methodology is then briefly presented, followed by the results obtained to date. A short discussion to wrap up the implications of this work concludes the paper.

Research background

Competitive priorities and manufacturing strategy have been of interest within the Operations Management (OM) domain for nearly half a century (e.g. Skinner, 1969; Hayes and Wheelwright, 1984; Swamidass, 1986; Anderson et al., 1989). Typically, the competitive priorities for manufacturers are those associated with cost, quality, speed, delivery and flexibility (Adam and Swamidass, 1989; Leong et al., 1990). For servitization, it has been recognized that manufacturers ought to take a different approach to traditional operations (Johnson and Mena, 2008; Baines et al., 2009), with the consequence that the competitive priorities will be different (Raja et al., 2015).

Moreover, the majority of the extant studies do not adopt the customer perspective when trying to ascertain customer priorities, but rather a provider perspective. This is an oversight given that understanding customer requirements is core to operations strategy formulation (Womack et al., 1990; Baines et al., 2009). It is the customer perception that should inform the competitive priorities of a manufacturer. Whilst the competitive priorities for manufacturing—the domain of operations strategy research—are well discussed in the extant literature (e.g. Fine and Hax, 1985; Miller and Roth, 1994; Joshi et al., 2003), there is little consideration given as to what these may be for manufacturers deploying a strategy of

servitization. It is advocated within the servitization literature that we should seek to understand how customers value services (Vandermerwe, 1990; Baines et al., 2009) and to do so necessitates seeing value through the eyes of the customer (Brady et al., 2005; Raja et al., 2013). This then underscores the need to address this gap by identifying and understanding these priorities for servitized manufacturers.

The customer perspective

Lele and Karmarker (1983) in their early work recognized the need to understand customer expectations of goods and services, whereas others were slow off the mark in addressing the customer perspective. This included those in the marketing discipline, where the voice of the customer is normally of central importance (cf. Griffin and Hauser, 1993; Naumann and Giel, 1995; Tuli et al., 2007); much of the literature still adopted a provider perspective (Neu and Brown, 2005; Gebauer et al., 2011; Sjödin et al., 2016).

Manufacturers need to understand the key stakeholders in the customer organisations (Kowalkowski, 2011) and accordingly attend to their needs in an efficient manner. The decision as to whether to purchase maintenance and support services for product offerings is often determined by buyers and end-users (cf. Cohen and Whang, 1997; Kowalkowski, 2011). The key individuals involved in buying decisions are typically based in procurement, maintenance, supply chain, as well as plant managers; it is these people who decide which goods and services are acquired (cf. Stremersch et al., 2001; Narayandas, 2005). This is particularly the case larger organizations operating in industrial markets. User also play an important role in influencing buyers in their decision-making. It is their actual usage experience that influences and provides valuable input to those in the buying group. This leads to the first working hypothesis:

H1: Customer role (buyer and user) will moderate the effects of provider-specific and relationship-specific determinants of customer satisfaction

The offering types

In practice, manufacturers that offer a type of servitized offering tend to create the term in line with their own corporate strategy (e.g. Rolls- Royce's Total Care or Xerox's 'document management'). Hence, there exists a plethora of definitions, which has led some scholars to classify different types of offerings into categories. Scholars have generally classified offerings into two (Gebauer et al., 2005; Mathieu, 2001) or three categories (Baines et al., 2007; Mont, 2004). The classification proposed by Tukker (2004) describes different types of product/service combinations in terms of product-, use- and result-oriented services. Cusumano et al. (2014) proposed smoothing, adapting and substituting services to classify different offerings. Conversely, base, intermediate and advanced services were used to identify three broad categories by Baines and Lightfoot (2013).

These studies largely focus on the characteristics or the function of the offering itself to categorize offering types. It must be noted that, in practice, these categories are highly customized. Therefore, in terms of what services are included in one category does not necessarily mean that these cannot be included in another. These categorizations are mainly around the function of the offering whether it is sold as a 'product' or 'use' or 'result'. As such, these definitions focus on the offering rather than the provision process. However, servitized offerings are delivered over longer periods and involve different degrees of integration and co-creation between manufacturers, customers and the rest of the network. To this end, a value driven co-creation process classification based on 1) basic service and 2) advanced service offerings has been proposed (Gebauer et al., 2005; Sousa and da Silveira,

2017). Mathieu's (2001) earlier work which discusses product-oriented services (i.e., product installation, spare parts provision and, maintenance and repair service) and customer support services (i.e., advanced form, such as use and result-based).

In this study, we build on previous research (Mathieu, 2001; Sousa and da Silveira, 2017), by considering servitized offerings in two broad categories: 1) *basic services:* that is, product-oriented services, such as installing and maintaining "*basic product functionality in an efficient and effective manner for the customer",* and 2) *advanced services,* that is, those concerned with customer support services which entail "*working closely with customers to co-create value that goes beyond basic product functionality, involving the customer's actions in relation to the product and the adaptation of the product use to the customer's unique needs, usage situations, and behaviors*" (Sousa and da Silveira, 2017, p. 446). The extant literature however does not detail the differences between basic and advanced offerings in terms of buyer and user groups. This leads us to argue for the need for clarity between different types of offerings to identify operational and relational idiosyncrasies pertaining to the different customer needs (i.e., buyers and users) and requirements from basic and advanced servitized offerings. This leads us to the second general hypothesis:

H2: The type of offering (basic and advanced) will moderate the effects of provider-specific and relationship-specific determinants of customer satisfaction.

Research methodology

This research used a grounded quantitative approach to understand the nuances in factors that affect the customer satisfaction of buyers and users of basic and advanced servitized offerings. We argue that this approach is more fitting than making an epistemic leap to a path model due to the lack of work on the phenomena we focus on. Drawing from extant research (Gebauer et al., 2005; Tuli et al., 2007; Kowalkowski, 2011; Raja et al., 2013), we identified and synthesized customer priorities that were posited to affect customer satisfaction. These constructs included, for example, information exchange and formalisation of the relationship, and customer-focus and innovation capability of the provider. We adopted established scales to design a questionnaire, which was administered broadly to business customers of servitized firms. The research adopted and adapted a range of multi-item scales1, as illustrated in Table 1. For instance, for customer focus, a seven-item scale from Chen and Paulraj (2004) was adapted. Each scale used seven-point Likert scales, anchored by "strongly disagree" to "strongly agree". For innovation, a three-item scale from Krause et al. (2001) was adapted. This was tested using seven-point Likert scales, anchored by "strongly disagree" to "strongly agree".

The deployed survey yielded 320 usable responses. The survey was targeted towards individuals in customer organisations that purchase and use servitized offerings. 125 of the respondents were solely buyers within their organisation, 85 were users, while the remaining 110 respondents occupied both roles. In terms of offering types, 177 respondents identified their respective offering as basic, whereas 143 as advanced services. The analysis of the survey was conducted using R software. The first necessary step of the analysis was to assess the validity and reliability of the scales. To that end, exploratory and confirmatory factor analyses were conducted in turn, following established procedures. Various items needed to be deleted to ensure that factors where distinct; discriminant validity was satisfied when all squared correlations between constructs were lower than the Average Variance Extracted (AVE) of the constructs.

To test the hypotheses, moderated hierarchical regression analysis using OLS estimation was used. Two dummy variables were firstly constructed: 1) for customer role we grouped

[1] Instrument is available upon request

customers who were solely buyers with those that were both buyers *and* users, to separate them from *solely* users who have not had buyer experience; 2) for offering type, product-service offerings were classified into basic and advanced. Analysis started by including the various factors of interest and two dummy variables in a regression model with customer satisfaction as the response variable. The second step comprised the addition of interaction terms between the dummy variables and all determinants of satisfaction (i.e., two interaction terms per factor), to directly test the hypotheses. As a last step, marginal effects were calculated in order to compare the effect of the variables between the four groups (i.e., buyers of basic offerings, buyers of advanced offerings, users of basic offerings, users of advanced offerings).

Table 1. Satisfaction related customer priorities as indicated by the extant research

Identified Construct	Indicative Sources	Measurement Scale
Customer focus	Galbraith (2002); Miller et al. (2002); Tuli et al. (2007); Baines et al. (2009)	Chen and Paulraj (2004)
Long term orientation	Lindberg and Nordin (2008); Brax and Jonsson (2009); Raddats et al. (2017)	Chen And Paulraj (2004)
Product quality	MacDonald et al. (2016)	Rosenzweig, Roth and Dean (2003)
Product-service range	Baines et al. (2007), (2009); Raja et al. (2013)	Safizadeh, Field and Ritzman (2003)
Formalisation	Karatzas et al. (2016)	Cannon and Perrault (1999)
Information exchange	Karatzas et al. (2017); Chakkol et al. (2018)	Chen and Paulraj (2004)
Innovation	Baines and Lightfoot (2013); Storbacka et al. (2013) Visnjic-Kastalli and van Looy (2013)	Krause, Pagell and Curkovic (2001)
Cost savings	Neely (2008); Fang et al. (2008); Visnjic-Kastalli and van Looy (2013)	Diaz, Machuca and Alvarez-Gil (2003)
Support systems	Baines and Lightfoot (2013); Lester (2015)	Chen and Paulraj 2004
Preventative maintenance	Chakkol et al. (2014); Karatzas et al. (2016)	Tu, Vonderembse and Ragu-Nathan (2001)
Satisfaction	Raja et al. (2013)	Cannon and Perrault (1999)

Analysis and Results

For parsimony, we are not able to report the full results of the regression (which are available upon request). Instead, Table 2 contains the results of the tests of significance for the interaction terms between the various predictors of interest, and the dummy variables denoting customer function (*user* versus *buyer*) and offering sophistication (*basic* versus *advanced*) that were included in the regression model. Customer satisfaction was the response variable. Statistical significance of an interaction term between a factor and a dummy variable would suggest that the effect of the respective factor varies between the two respective groups.

The results suggest that the effect of two variables (support systems and innovation capability of the provider) on customer satisfaction is statistically significantly different for customers who are *just users* of the offering versus customers who are *buyers* (that is, solely or buyers *and* users). Similarly, the effect of two variables (product quality and achieved cost savings) on customer satisfaction is statistically significantly different for customers of *advanced* versus customers of *basic* product-service offerings.

Table 2: Condensed results of significance testing for the interaction terms with customer satisfaction as the dependent variable

	. Qual.	. Range	Long-term Orient.	Formali-sation	Customer Focus	Info Exchange	Supp. Syst.	Innov.	Cost	Prev. Maint.
User (v. buyer)	--	--	--	--	--	--	**	*	--	--
Advanced (v. basic)	**	--	--	--	--	--	--	--	*	--

Note: Cells report the test for the statistical significance of the interaction term between the respective predictor and dummy variables.

**, * indicate statistical significance at 5% and 10% level, -- indicates that there is no difference between the two groups

To better demonstrate the implications of these results, it is worth directly comparing the total effects of the variables on the satisfaction of the four distinct groups of customers, in terms of both direction and strength. This was done by deriving the *marginal* effects of each variable, while controlling for the influence of the remaining variables. These are included in Table 3, and summarized in what follows, by taking each independent variable in turn.

Table 3: Marginal effects for the different groups of customers

	Qual.	Range	Long-term Orient.	Formali-sation	Customer Orient.	Info exchange	Supp. Syst.	Innov.	Cost	Prev. Maint.
Buyers of basic offerings	0.077	0.034	0.045	0.089	0.38***	0.12	-0.14**	0.18	0.29***	0.19**
Users of basic Offerings	-0.001	0.22*	0.23	-0.05	0.53***	0.14	0.045	-0.13	0.11	0.11
Buyers of advanced offerings	0.35***	-0.06	0.02	-0.05	0.41***	0.1	-0.05	0.07	0.08	0.23***
Users of advanced offerings	0.27	0.12	0.2	-0.18	0.56***	0.12	0.13*	-0.24	-0.09	0.15

Note: ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively

Quality is found to be significant for customers of advanced offerings, and particularly for *buyers* of these offerings, where the effect on satisfaction is very strong and positive (p-value < 0.01).

Product-service range is more important for *users*, and in particular for users of basic products. We suggest that this is because they have more leeway to customise the servitized offering of the provider (p-value < 0.1), while the offering is *in-use*.

No statistically significant effect of long-term orientation is detected; however, the sign and magnitude of the coefficients suggest that it is more important for users. This implies that users would like to see a continuity of the relationship with the manufacturer, as opposed to buyers who may be more oriented towards individual transactions. Moreover, this long-term

orientation, or lack thereof, may be a factor of the inherent short-term perspective of buyers who maybe focused on a short-term gain on costs rather than sustaining long-term relations.

No statistically significant effect of relationship formalisation is detected. However, the sign and magnitude of the coefficients suggests that the satisfaction of users of advanced offerings may be negatively affected if the provider maintains a strictly formal relationship with the customer. This suggests that more advanced offerings require the flexibility of an inter-organizational governance regime that meshes both formal and informal mechanisms.

The effect of customer orientation on satisfaction is always positive and strongly significant. Interestingly, this positive effect increases as we move from buyer to user and from basic to advanced offerings. This suggests that users may view themselves more as the customer, while advanced offerings require greater customer orientation to understand the nuances of the servitized offering in context.

Information exchange has a universally positive (but insignificant) effect. The insignificance of the effect could be justified due to its effect being confounded with the effect of other predictors (and in particular customer orientation, which reflects information exchange to some extent).

An interesting picture emerges for support systems. For buyers of basic offerings, the effect on satisfaction is negative and significant (p-value < 0.05). This may be because, for them, support systems could be a 'nuisance' leading to information overload, unnecessary effort and wasted time, since they are unlikely to see the benefits of these systems. Conversely, and reasonably enough, the effect is positive and significant (p-value < 0.1) for users of advanced offerings, who could be making use of these systems, and derive benefits out of them, on a day-to-day basis.

No significant effect of the provider's innovation capability on customer satisfaction is detected. However, buyers seem to see an innovative provider positively, as opposed to users who see it negatively. This suggests that users view innovation as a form of unwanted change, hindering them to get on with the standard service task at hand.

Cost savings affect positively and significantly (p-value < 0.01) the satisfaction of only buyers of basic offerings, supporting the idea that this type of customers are the ones who are more likely to consider the buyer-supplier exchange as a transaction that should produce measurable, short-term results.

Preventative maintenance has a universally positive effect on satisfaction. However, this effect is significant only for buyers, and very strong for buyers of advanced offerings. This may be because buyers could consider preventative maintenance as an important factor (or simply as a safeguard) to proceed to the product-service provision agreement.

Concluding summary

This research examined the differences in priorities of i) buyers, and ii) users of *basic* and *advanced* servitized offerings. The research used a more grounded, quantitative approach than typically seen when deploying an approach such as path modelling. By adopting this approach, we determined that there are distinct nuances between the four distinct groups of:

- buyer of basic offerings,
- user of basic offerings,
- buyer of advanced offerings, and
- user of advanced offerings.

Customer orientation was positively associated with customer satisfaction for all four groups. However, the customer satisfaction of only buyers of offerings, both basic and advanced, was positively influenced by preventive maintenance. Moreover, support systems negatively affected customer satisfaction for users of basic offerings, while users of advanced offerings were positively affected by it.

These results indicate that manufacturers need to acknowledge that there is no 'one size fits all' to delivering and supporting servitized offerings. Instead, they need to understand which priorities matter and how to best deliver them.

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How to Make or buy procurement: a change management model

Sarrah Chraibi
GIP Campus ESPRIT Industries, LEGO (Université de Bretagne Sud) - Address: 26 Quai Surcouf, 35600 Redon, France; Tel: +33 634 449 194;
E-mail: sarrah.chraibi@gmail.com

Tony Cragg
GIP Campus ESPRIT Industries – Address : 26 quai Surcouf, 35600 Redon, France ; Tel: +332 99 71 60 20 ; E-mail: tcragg.esli@campus-redon-industries.com

Abstract
This paper proposes an iterative model for the make or buy of procurement linked to organizational change management. Based on an in-depth, longitudinal, action-intervention case study of the procurement function at the French Railway company, a five-step model was developed that links the make or buy decision to organizational change. Both the outsourcing of procurement, as a strategic activity of the firm and the proposal of a model for the outsourcing process remain underexplored in the academic literature. This paper aims to contribute knowledge to how the key function of procurement can be successfully reorganized in a large firm as part of a change process.

Keywords: Make or buy; Outsourcing; Procurement; Organizational change management

Introduction

Outsourcing the procurement function might appear to be counter-rational, given that this department is a strategic part of any organization with responsibility for both the purchasing budget, representing between 50 and 90% of the cost of goods sold in industrial firms (Emiliani, 2010), and for setting up cooperative supplier relationships to enhance a firm's competitive stance. However, the drive for efficiency savings and the availability of specialist skills on the market in recent years have pushed firm boundaries further inwards to include core activities. A range of more strategic functions are now considered as candidates for outsourcing, including, for example, human resources (Belcourt, 2006; Norman, 2012) and R&D (Contractor et al., 2010; Martinez-Noya and Garcia–Canal, 2012).

The Resource Based View (RBV) (Barney, 1991) advocates that a firm's core activities should be developed and protected internally, while non-core activities can be more readily outsourced. Transaction Cost Economics (TCE) (Williamson, 1975; 1985) suggests that where both the asset specificity level of an activity is high, and the transaction costs involved in performing the activity externally are greater than the internal costs, then the activity should be retained in-house. From these theoretical perspectives, outsourcing the strategically important procurement function, which can be considered as both high human asset specificity and a core strategic activity, appears non-rational. Nonetheless, the focus of this study is on the restructuring of the procurement function, including its outsourcing, in a case study of the French national railway company.

Therefore, the research questions that this paper seeks to address are how can such a reorganization of the make or buy of procurement be explained and what is the appropriate process framework? Since there is a need to go beyond the TCE and RBV paradigms in trying

to understand rationale and processes, the theoretical net was cast wider to include organizational theory and endogenous factors. This study of the make or buy of procurement is based on organizational change management and in particular internal dynamics and interests that need to be taken into account alongside rational transactional considerations.

The originality of this research is that it is one of a small number of academic studies that focuses on an unusual area for outsourcing, namely the organizational function that is usually, itself, responsible for outsourcing. Against a theoretical background which acknowledges both rational and non-rational explanations to outsourcing, an action-intervention research programme (Rispal, 2002; Naslund et al., 2010) was carried out, in which the researcher actively participated in the preparation, scope, analysis and decision making process of a make or buy procurement project in the French national railway company. Based on this case study, we developed a process model for the review and reorganization of the procurement function in a large firm.

This paper begins with a review of the literature relating to outsourcing procurement, followed by consideration of TCE, RBV and supplementary theoretical perspectives. Having examined the literature relating to organizational change management and presented the methodology employed, the authors explain in detail the make or buy procurement model. This is followed by a discussion and conclusion.

Literature Review

Outsourcing procurement: a step too far?

Although a number of articles on the subject of outsourcing procurement can be found in trade and professional journals, there is a dearth in academic journals and in those that have been published, there are noticeable differences: ranging from the advantages of outsourcing procurement as a means of controlling costs (Olson, 2010) to warnings of the risks of losing control over supplier costs through loss of visibility (Parry et al., 2006). The initial problem is that procurement not only encompasses both strategic and tactical activities (the purchasing and sourcing of more or less essential supplies of goods and services), it is also a function that necessarily spans the boundaries of the firm through its links with the supplier base. As a strategic function it is the key organizational link between internal requirements and the external market. Chen and Paulraj (2004:121) emphasize the criticality of this linking function, in the following terms: “The buyer–supplier dyad […] is of paramount importance to the effective management of the supply chain”. Furthermore, one of the main constituents of an efficient real world social network (Borgatti and Li, 2009; Hearnshaw and Wilson, 2013) is a short characteristic path length (a small number of tiers or firms between any two nodes). This leads onto the question of whether outsourcing this function and placing an intermediary between buyer and supplier can be viewed as an outsourcing too far?

To respond to this question it is important to distinguish between strategic and tactical procurement. Brewer et al. (2013) studied outsourcing procurement as a logical further step after the outsourcing of manufacturing. They saw the growth of contract manufacturing (CM) not just as sign of a “temporary relief valve” but as a “strategic supply chain partner” (Brewer et al., 2013: 91). From this perspective, following manufacturing out of the door with procurement of basic inputs or tactical activities was found to be coherent. This study focused on the electronics industry, where contract manufacturing is highly developed and competent large sub-contractors exist. However, the researchers found that CM competence only influenced the outsourcing of tactical activities, suggesting that firms still view outsourcing strategic activities as a step too far or as vital “crown jewels” (Venkatesan, 1992).

Indeed Chraibi et al. (2017: 146), in their recent study of six large firms from different sectors, confirm the delicate nature of outsourcing the purchasing of strategic or core activities: "Our research also indicates that outsourcing strategic purchasing can be very risky and cannot be undertaken without the required maturity level and without fully prepared contract management." Brewer et al., (2014) reviewed the outsourcing procurement literature and found that extant published research on this subject was mainly exploratory and atheoretical. Their research is based on TCE and RBV theoretical perspectives, which these authors see as "the most concise lenses for examining the outsourcing decision" (Brewer et al., 2014: 187).

TCE and RBV perspectives

Researchers that have studied outsourcing from the TCE perspective (Walker and Weber, 1984; Poppo and Zenger, 1998; Osei-Bryson and Ngwenyama, 2006; Busi and McIvor, 2008; McIvor, 2009; Kirkman and Phillips, 2011; Nordigarden et al., 2014; Tjader et al., 2014), argue that firms can outsource when transaction costs are lower than production costs. Williamson (1975) identified three dimensions of transaction: operation frequency, uncertainty and, most crucially, asset specificity. Outsourcing highly specific assets may be critical (Quinn and Hilmer, 1994), as it can generate two capital dangers: the standardizing of transferred assets (Ang and Cummings, 1997) and hold-up (Klein et al., 1978). Williamson highlighted other dangers such as complexity, opportunism, uncertainty and information asymmetry, which result in outsourcing creating additional costs generally ignored in the decision-making phase. In addition, researchers pointed out other dangers like dependency (Kirkman and Phillips, 2011), competition from an external vendor which benefits from the firm's transferred knowledge (Kirkman and Phillips, 2011), cultural lag, loss of competencies and loss of control (Barthélemy and Quélin, 2006).

Transaction cost theory is based on two key assumptions: bounded rationality and opportunism. Williamson maintained that the potential costs engendered by bounded rationality and guarding against the risk of opportunistic behaviour are best mitigated through internalization: through hierarchical organizations which can manage and contain the uncertainties of the marketplace: "Agents who are skilled at dissembling realize transactional advantages. Economic man…is thus a more subtle and devious creature than the usual self-interest seeking assumption reveals" (Williamson, 1975; 255). Williamson posed the problem that daily economic life is riddled with mistrust and dishonesty and that the solutions are to be found in legal, financial, political and social institutions to provide order to the economic jungle. These institutions render malfeasance too costly to engage in. Williamson argued that where transactions are uncertain, frequent and require considerable investment, they will take place in-house, whereas those that are relatively simple, one-off and standard will be carried out in the marketplace: only where transaction costs are lower than the costs of carrying out the activity internally is outsourcing recommended. In effect, Williamson sees the authority-based relations inherent in corporate hierarchies as a means of controlling risk and taming the opportunistic behavior inherent in market transactions.

RBV is more recent than TCE but several researchers have relied on RBV to analyze the outsourcing question (Quin and Hilmer, 1994; McIvor, 2005; Di Serio et al., 2011; Nordigarden et al., 2014). They recommend that, while firms invest in resources that they believe can provide a competitive advantage, only "strategic" resources can give the advantage sought (Wernerfelt, 1984). The strategic character of resources is determined by indicators that differ depending on the adopted model (Amit and Schoemaker, 1993). While researchers recommend that strategic resources remain in-house, they also argue that the transfer of material resources is more easily achievable than the transfer of human resources, since, in the latter case, there is a risk of a loss of individual expertise to the organization. In general, from the RBV perspective, the outsourcing decision can be considered when the best external service providers are more

efficient than the internal service available (Teng et al. 1995). However, the core/non-core dichotomy remains the central plank of the RBV perspective and thus the researcher must return to the question of what is and what is not a core activity, where is the border between the two drawn and perhaps most importantly, by whom. In so doing a rationalist paradigm is brought into question by subjectivism.

TCE and RBV have provided a framework for understanding the outsourcing decision on the basis of rationality: such that where an activity is non-core and has low asset specificity, it can be outsourced. Therefore organizational objectives will include protecting core functions and outsourcing non-core in order to secure competitive advantage (Holcomb and Hitt, 2007). However the theoretical prisms of TCE and RBV are not the only frameworks for understanding the outsourcing process.

Supplementary theoretical perspectives

Recent research has taken a more critical view of understanding outsourcing on the basis of TCE and RBV. McIvor (2009) acknowledges that the complexities of outsourcing cannot be fully explained by TCE and RBV. Research has also shown that organizational politics and behaviour (Marshall et al., 2015) play an important role in outsourcing decision making and implementation processes. The qualitative research of Bidwell (2012: 1622) shows "the value of understanding make-or-buy decisions as an endogenous consequence of the structure in which those decisions take place, rather than as isolated decisions that are maximized regardless of their context". This research stream suggests that the notions of rational behavior inherent in TCE and RBV may be a necessary, but not sufficient, theoretical perspective for explaining outsourcing and that in particular; rational processes do not inevitably lead to successful outcomes. Therefore a move towards a multiple theoretical framework has begun that also makes reference to economics, strategy and organizational behavior (Ellram et al., 2008).

The outsourcing decision may be motivated by optimizing costs and improving flexibility (Kelly, 1995; Kirkman and Phillips, 2011; Di Serio et al., 2011), technological transfer and access to knowledge and expertise (Kirkman and Phillips, 2011). Other anticipated benefits from outsourcing include refocusing on the core business or improving product or service quality perceived by users of the external provider (Fimbel, 2003). Kumar et al (2010) pointed out the concept of time and external dimensions related to market analysis. McIvor (2000) highlighted the importance of the existing relationship with the external provider. Therefore, research shows that endogenous and exogenous, rational and non-rational factors drive the outsourcing process. In this research, we focus on organizational change as an important driver of the outsourcing procurement process.

Organizational change management

Theoretical perspectives on organizational change management begin with Lewin (1951), who suggested a three-step process of change: "unfreeze" which is to recognize the need for change; "move" which is to plan actions toward change; "refreeze" which is to maintain change. Bullock and Batten's (1985) change model is divided into four phases: exploration, planning, action and integration. Kotter (1995) suggested eight steps of change: establish a sense of urgency; form a powerful guiding coalition; create a vision; communicate the vision; empower others to act on the vision; plan for and create short-term wins; consolidate improvements and produce yet more change; institutionalize new approaches (Cameron and Green, 2009). More recently, Walsh and Renaud (2010) discussed five moments of change: perception of the need for change; identification of the resources involved and problematization; profit-sharing and alliances; roles distribution, engagement and mobilization of spokesmen. Prochaska and Clemente (1982) pointed out four stages of change: contemplation; determination; action and holding. In an extensive literature review, Hornstein (2015) emphasized the importance of the change process in project management. He found that the success of a project depends on the

success of the change management process and, furthermore, the importance of close collaboration between the project leader and the change leader.
Pinto (2005) developed a scheme for the combined management of a project cycle (launch, deployment and result) and change cycle (unfreeze, move and refreeze) (based on Lewin, 1951). Every step of the project cycle requires actions arising from the equivalent change steps. Thus, the launch and deployment steps meet an unfreeze phase induced by the organizational change. In this stage, it is recommended to communicate about the project to ensure good understanding and monitor its implementation. During the result phase of the project, it is recommended to ensure the alignment of results in response to movements, disturbances and variations induced by change. After the result phase, a stabilization phase of change sets in, during which it is recommended to measure results in order to evaluate the contribution of the project and draw relevant lessons.
Using the organizational change process of Lewin (1951) and the literature review, we developed a scheme that summarizes, in our view and in a simplified manner, the process of organizational change:

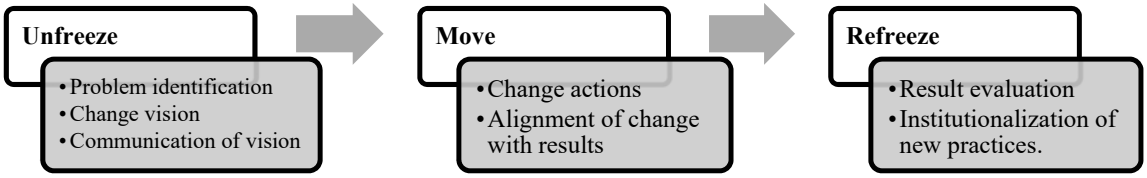

Figure 1: Organizational change management process (simplified version).

Methodology
The methodology followed is an in-depth, longitudinal case study, over a period of four years, based on action-intervention research (Naslund, 2002; Rispal 2002), given that this project involved both observation and involvement in an organizational change process.
The literature shows that the decision to outsource plays a key role in an outsourcing project. Outsourcing needs to be sufficiently considered and studied before any decision is taken. For Barthélemy and Quélin (2006) the decision to outsource needs to take into account the strategic perimeter, financial estimations, drawing up specifications and contracts. For Quèlin (2007) it begins with a risk analysis, a comparison of organisational options, an analysis of the outsourcing conditions, choice of the service provider and the type of relationship expected.
For the outsourcing of purchasing, we refer principally to Chraibi et al. (2017), which presents the seven stages, namely: analysis of purchasing core business, analysis of costs and performance, plan, service provider selection, negotiation, ensure smooth transition and finally, manage the relationship. The integration and involvement of the researcher in the early stages of this project, through observation, interviews and focus groups allowed her to note that the different steps recommended in the literature were not followed in their entirety. Instead an approach specific to the company was adopted, in response to its requirements, such as urgency, resource constraints and context. However lessons were drawn which added to the findings of the literature.

A make or buy procurement model
Marshall et al. (2005) have noted that, despite the abundance of articles on outsourcing, there is a lack of outsourcing process models. In response, they developed their own iterative model. In this research a connection is made between organizational change management and the make or buy decision involving procurement activities, with reference to the project/change cycle of Pinto (2005). Based on the literature review, presented earlier, we developed the following

three-step preliminary model, which was subsequently tested in the field and improved to apply to the operational make or buy context. It starts with the **Launch** step:
Once a problem is identified, the Purchasing management team studies the options and chooses a make or buy solution, which could be linked to a need for alignment with company strategy. Once a make or buy project has been launched, in depth objectives are set out and a project team created. Several configurations are possible, depending on the nature of the firm, the maturity of the purchasing function and expectations of make or buy.
Secondly the **Deployment** step: elaborate the action plan, risk analysis, strategic alignment with top management, analysis of internal and external procurement scope, costs and performance analysis, choice of either make or buy, communication about the choice, preparation for implementation with new structures, staff training and skills management. This step also includes the implementation of the make or buy solution, a transition phase and driving the make or buy of procurement activities (monitoring the project's deployment, management of the external vendors and incentive actions). Finally, we reach the **Results** step: results evaluation; corrective or/and holding actions; institutionalization of new practices; monitoring of the reversibility of the outsourcing program and benefiting from lessons learned.

Figure 2: Preliminary three-step process of make or buy (Simplified version).

The preliminary study based on interviews and focus groups with team leaders produced the model in figure 2. The researcher was an active participant in a project team composed of representatives from various procurement entities of a French Railway company (SNCF Réseau) – 12 people in a project team.
The case involved is one of the most ambitious, significant and complex outsourcing of procurement projects in Europe and therefore is of considerable value as a unique subject for study. Flyvberg has underlined the value of a single case, both for generalization and as example (2006; 228):

> "One can often generalize on the basis of a single case, and the case study may be central to scientific development via generalization as supplement or alternative to other methods. But formal generalization is overvalued as a source of scientific development, whereas "the force of example" is underestimated".

The driving force behind the project was the merger of two separate entities within SNCF. Each of these entities presented different procurement practices, in particular in relation to the situations in which external procurement expertise were sought. In one case a lack of internal specialists led to a regular demand for external services and in the other case, outside procurement firms were only solicited at times of peak activity or for particular missions. Consequently, the organization perceived the need to harmonize these two different approaches into a single coherent strategy through a change management project.
The data used is collected from internal documentation and discussion (Rapley, 2007), brainstorming, focus groups, observation (Flick, 2009), experiments and the contribution of the project team to research. The validation of our model is based on experiments, because our intervention is at the heart of the project and therefore proposals were adapted following discussions and observation of the evolution of different phenomena. The project team was composed of managers and responsible staff from several procurement entities, and was monitored periodically by the Purchasing Director, to check work progress and ensure the feasibility of work done.
Thus, we used this preliminary three-step process (Figure 2) in our fieldwork to test its validity and to make it more suitable operationally. For this purpose, we took into account the constraints and characteristics of the research field that had been observed and communicated

by the project team. As a result of these observations and discussions, our three-step make or buy process evolved into a more developed five-step model, presented below (Figure 3). For reasons of confidentiality the study results are not presented, only the methodology and process are developed in this article.

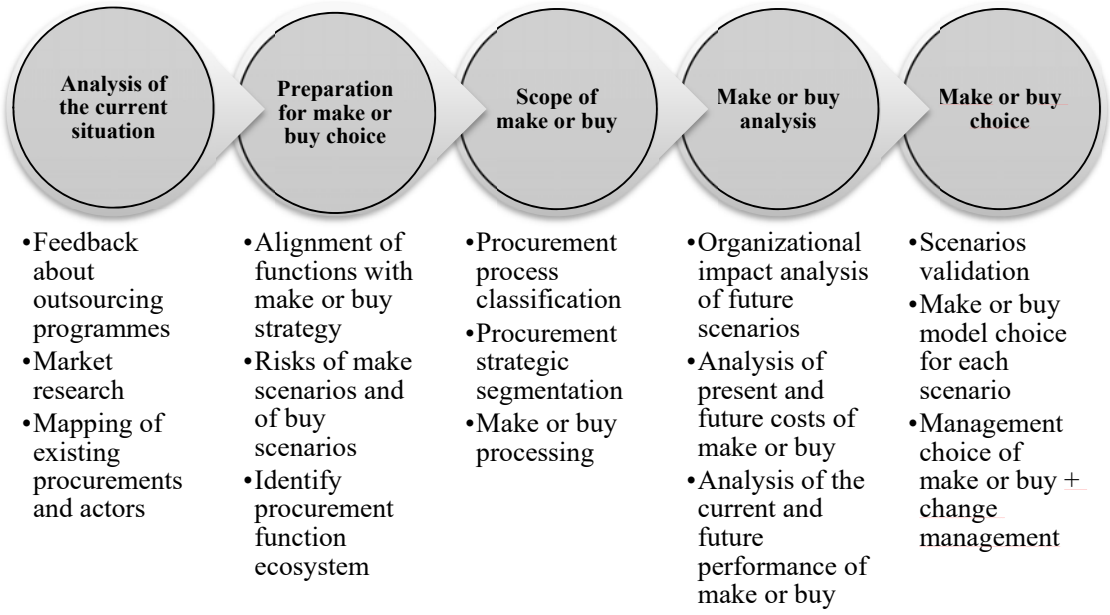

Figure 3: Five-step process of make or buy of procurement activities

The five steps in the make or buy of procurement activities are described as follows:

Step 1 – Analysis of the current situation:
The analysis of the current situation is dedicated to studying the outsourcing practices of the procurement function, namely the nature of outsourced procurement, the typology of outsourcing contracts, the challenges, and the key success factors. This step took six months, because it raised the fears of the managers of the different purchasing teams, such as: *"why do we need to outsource?", "will there be a loss of jobs?", "will outsourcing change our way of working ?*
At first the representative from the different teams focused on the dangers of outsourcing, and explanations were given to them, including the arguments that there is also internalisation in a make or buy project and that the objective was to find the optimal solution for Purchasing senior management. Once the information from interviews and documentation had been collected and analysed, the fears expressed impacted on the time taken and required the intervention of the Purchasing Director to unblock situations.
The main objective of this step is to draw the key lessons from previous and current outsourcing programs and to obtain a better knowledge of the firm's own practices, strengths and weaknesses. This step identifies the procurement practices currently outsourced by SNCF Réseau and by the parent company – those areas where competence levels are high and those where improvements need to be made. So the composition of the procurement activities is ascertained and this is clearly mapped (Bruel et al. 2014), allowing greater control of the process. Additionally market research gathers information about the external availability of procurement services that could meet outsourcing needs.

Step 2 - Preparation for the make or buy choice:

During this step, with the apprehensions of the different members alleviated and their involvement increased, the project was able to advance more rapidly. Brainstorming and focus groups were the working methods employed.
The preparation for the make or buy choice starts with the alignment of the procurement function with the company's strategy (Bruel et al. 2014). It is important to understand and assimilate the vision and overall strategy of the company to guide the make or buy choice and in order to secure both financial support and commitment from top management. To study the negative and positive risks, we focus on the international standard ISO 3100: 2009 (Purdy, 2010) to apply it to the make case first, and to the buy case afterwards, before relating them to the particular case of SNCF Réseau, taking into account its context, environment, the sector and inner working mechanisms.
Finally, the project team defines the ecosystem (Peltoniemi, 2006) of the procurement function to identify entities that may be affected by a make or buy decision. The ecosystem can be internal, such as stakeholders, top management, other functions, etc. or external, such as suppliers, competitors, government, etc. Defining the ecosystem of the procurement function enables the organization to identify potential opportunities for collaboration and target its communication and actions.

Step 3 - Scope of make or buy:
Focus groups and analytical reports prepared the project team for the make or buy choice. With this information, the team was able to analyze the scope of procurements affected by this choice and classify procurements according to the purchasing-procurement process; from tactical to strategic (Kaufmann, 2002), and according to their complexity; Class A, Class B and Class C (Roy and Guin, 1999). The project team also focuses on the strategic segmentation of the purchasing activity, on its maturity (potage, 2017), practices, methods and tools used in the company. Each purchasing entity is evaluated separately on the maturity of its purchases and purchasers in each of the distinct families, which are individually mapped. This issue raised another set of difficulties, since team managers were reluctant to declare that their buyers lacked skills, in case external skills were sought to make up for the lack of internal skills, or that they were overloaded, in case the «extra» workload was then outsourced. They also did not want to declare that the buyers did not have enough work, in case they were given extra responsibilities outside the perimeter of their department. The Purchasing Director had to intervene to repeat the objectives of the study and its importance. The step lasted three months.
The consolidation of this data, reviewed by the Purchasing Director, enables a global analysis of the company's purchasing function.
For an in-depth analysis, the project team conducts a SWOT analysis (Helms and Nixon, 2010) of the procurement function. In our case, the objective of the SWOT analysis is to examine the strengths, weaknesses, opportunities and threats related to the procurement function as a whole, and related, in particular, to procurement segments and macro-segments.

Step 4 – Make or buy analysis:
The SWOT analysis helps in the proposal of improvements, correction and capitalization of the procurement function. Based on these proposals and the previous analysis, the project team suggests the first future scenarios of the make and the buy, and then analyzes their organizational impact and their costs and performance. Furthermore, a comparative study focuses on the existing and future costs of the different scenarios, and on the existing and future performance forecasts. Thus, these projections greatly help in the final choice of whether to carry out each procurement activity internally or externally. This step lasted two months.
The presence of representatives of the different entities in the project team enabled specific problems to be raised and taken into account in the choice of future scenarios. These

representatives possess a more operational vision of purchasing which was confronted with the more strategic vision of section managers and the Purchasing Director. Consequently, different propositions were modified and a consolidated make or buy organisational vision was reached. This step of the process shows the confrontation of objectivist and rationalist (TCE and RBV) approaches, as exemplified by a comparative study, with endogenous factors (Marshall et al., 2015), represented by the input of the operational teams with concrete experience of the organisation's day-to-day procurement activities.

Step 5 – Make or buy choice:
Once a decision to make or buy a procurement activity has been confirmed, the project team submits its proposal to top management for approval. The project team focuses on the validated scenarios to develop the implementation model, which includes progress monitoring and effectively managing the change process for each scenario. The project team also defines the roles and functions of the resources involved in each case (Walsh and Renaud, 2010), communicates more officially about the selected scenarios, manages the transition process and ensures the monitoring of key performance indicators.
For the buy scenarios, the project team participates in the writing of specifications, in the selection of the buy management committee, in setting up the basis of the management of the relationship with the suppliers of external services, in order to ensure practice standardization over the procurement function. For the make scenarios, the project team participates in establishing reversibility and contract termination of the affected outsourcing programs in order to ensure compliance with practices introduced by the scenarios. It took one month to formalize this step. Fig 4. shows the timeframe for the whole process.

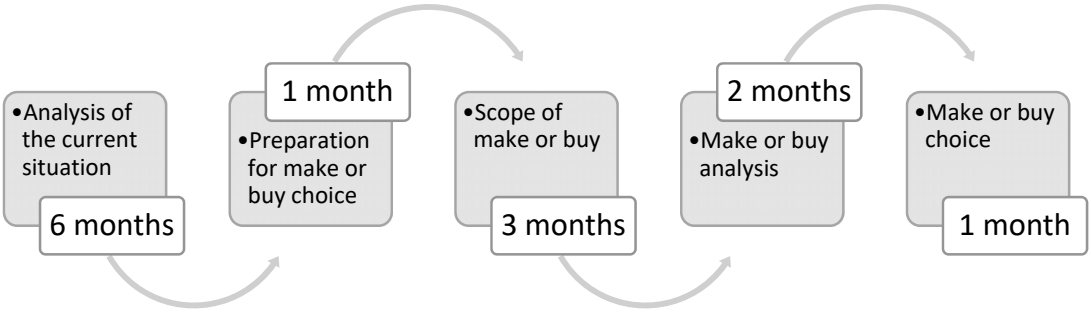

Figure 4: Timeframe for the five-step process of make or buy of procurement activities

Discussion
Following the findings of recent research that outsourcing decisions can be related to endogenous organizational factors (Bidwell, 2012; Marshall et al., 2015), this research, equally, sees the reorganization of make or buy as linked to internal dynamics: in this case the merger of two previously distinct entities and the need for a global company approach to procurement. We then produce a model to show how this reorganization was part of a change management process and was implemented in practice. Our research identifies four key elements underlying this process, which need to be taken into account in the management of change in a large firm's procurement department:

1. Change within change. It is important to note that the participants evolved over the course of the project – that the project team itself was subject to change. The number of middle managers involved in the project team grew and in some cases their role changed. For example, middle managers that initially represented a purchasing team in one of the merging entities, switched to represent another to which they subsequently belonged. This produced changing dynamics within the project team.

2. Managing the new buy process. Our experience shows that in the case of buy, before drawing up specifications, there is a need to share the results of analysis with management to ensure their alignment with the company's global strategy. Also, there is a need for the teams that work on a daily basis with the service providers to contribute to the specification process and to the selection of service providers, given that they will have to manage them in the future. During the project some difficulties were encountered mainly linked to fears around the critical nature of the negative risks (Purdy, 2010) associated with a buy scenario. In fact, some members of the project team (representatives at the middle management level) regularly expressed their reticence to a buy scenario and the negative implications for the company *"We don't need to outsource purchasing, it's a bad idea […] we know very well how to purchase ourselves"* (One Manager of a Purchasing department). Thus, buy scenarios, generated by rational evaluations and projections, were often challenged by internal resistance.

3. Listening to protest. In the terminology of Autissier and Vandangeon-Derumez (2007) these middle managers represent *« the change protesters »*. In order to encourage an objective approach in the choice of scenarios, brainstorming sessions on the risks of make or buy and reminders of project aims allowed the whole project team to 'buy into' the resulting decisions. The success of the project was aided by the presence of 'opinion leaders', with objective or non-partisan views on the subject. *"The Purchasing Director's close interest in the project was key to its success […] this meant that areas of disagreement could be negotiated, the strategic importance of the project was regularly underlined and that the project was aligned with company strategy and policy"* (Member of the project team). Project team meetings with the Purchasing Director at regular intervals provided arbitration over points of difference or conflicts within the team and ensured that the project progressed in line with the company's global strategy. The resistance expressed by certain middle managers gave the project team an understanding of the perception of the members of the purchasing teams, which enabled the project team to develop its internal strategy and to anticipate reactions on the ground. Additionally, early informal feedback from the middle managers to their teams meant that the state of progress of the project was widely known.

4. Effective communication. The literature review (Kotter, 1995; Pinto, 2005) shows that one of the most important determinants of a successful organisational change management project is communication. The proposed make or buy scenarios constituted a significant transformation of purchasing activities and team organisation. Both internal and external communication were essential via information sessions and newsletters. Particular attention was paid to buyers, who experienced major changes to the organisation of their workload and required explanations of the rationale behind these changes and the results anticipated. It was also essential to communicate with suppliers affected by the reorganisation, who were beginning to receive orders from subcontractors, rather than internal buyers. Articles published in the professional press were monitored to ensure that they did not contain information likely to stoke tensions within the firm or cause misunderstandings.

Conclusion

To conclude, it is important to underline some points about the implementation of this process and model in the case study. The integration of representatives of the different procurement entities in the project team helped to have a global vision at the operational level and meant that our model was the result of the collective input of a number of professionals. From a methodological perspective, this added validity to the research. The integration of these representatives in the project team facilitated an effective preparation phase (Step 2) for what was a transformative project. We noticed throughout our research that some members of the

project team showed some unwillingness and resistance to the buy scenarios. Behind this resistance lay the fears of their teams and sometimes of themselves. Their participation in the project team helped to adapt our model in order to anticipate and master these apprehensions at the earliest stages of the project and to enable effective two-way communication channels between the procurement entities and the project team. This inclusion in a major strategic project reveals the importance of an organizational change management process for a reorganization of the make or buy function.

With reference to the literature review, the change process can be seen as a minor struggle between those who represent day-to-day procurement experience, maintain the status quo and defend their interests and the drivers of change, who employ rational and objective criteria as tools of persuasion. The managerial authority of the latter group meant that, ultimately, they prevailed, but not without concessions, being secured and adaptations made. Therefore, explanations for the outcomes of the make or buy review project would need to consider both rational (TCE and RBV) and organizational factors (Marshall et al., 2015), that operate simultaneously and are often confronted one against the other, requiring arbitration and eventual compromise.

This paper suggests a model for the reorganization of a company's make or buy function, regardless of its class (ABC) and its strategic level (from purchasing to procurement). This model is based on academic research in the field of make or buy, and change management. We strengthened and improved the model through an in-depth case study applied to SNCF Réseau. In this case, the driving forces behind the project to review and reorganize procurement activities were the merger of two separate entities, the need to progress organizational change and the objective of coherent and comprehensive make or buy strategy and practice. We have not applied this model yet to other companies but we do not exclude this approach for further research. However, we believe that an in-depth case study can be relevant. In this paper, we have not presented the results of our model applied to the case of SNCF Réseau, for reasons of confidentiality and we prefer to focus on how we developed a model of the decision making process for the make or buy of procurement activities, since this subject is still underexplored by scholars. We hope that our research will open the way to further reflections.

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Demand aspects of RoRo shipping services

Anastasia Christodoulou, Postdoctoral Researcher, Department of Business Administration, School of Business, Economics and Law at University of Gothenburg, P.O Box 610, 405 30 Gothenburg, Sweden, Anastasia.christodoulou@gu.se, Phone +46 31 7866437.

Summary

The integration of shipping into 'green' supply chains represents a big challenge for the transport industry. This paper analyses the purchasing chain of RoRo shipping services and identifies the determinants that have impact on its competitiveness. A taxonomy of determinant factors in the purchasing process of RoRo shipping services is developed highlighting the interactions between them and drawing attention to the barriers that prevent the further employment of this transport mode. The results suggest that a different management 'culture' on carriers-shippers' relationships and efficient port operations are key determinants for the establishment of successful intermodal RoRo services.

Key words: purchasing, RoRo shipping, intermodal chains.

Introduction

The 'green' transportation of goods has been an issue of major concern during the last decades with a special focus on the development of intermodal supply chains and the further use of environmentally friendly and energy efficient transport modes. Maritime transportation offers significant environmental advantages as it transfers more than 90% of the global trade in volume while emitting around 2.2% of the total global greenhouse gas (GHG) emissions (Smith et al., 2014). The integration of shipping into 'green' supply chains represents a big challenge for the transport industry and has not been achieved until now despite the various initiatives taken by various stakeholders (European Commission, 2011; Ng et al., 2013). Various segments of the shipping industry present great differences in their purchasing and supply chain management, which need to be taken into consideration for the adoption of effective policies and incentives that could lead to the further use of shipping in intermodal transport chains (Casaca and Marlow, 2005).

Roll on-Roll off (RoRo) shipping represents a maritime segment that could easily form part of an intermodal transport system and contribute to the development of sustainable transport chains, as cargo does not need to be transhipped in ports, it is 'rolled' to and from sea on its own wheels (Perakis and Denisis, 2008). In this respect, sea could be seen as an extension of land-based transportation and 'motorways of the sea' is a relevant expression that refers to the establishment of specific routes for the employment of short sea shipping. The purchasing of RoRo shipping services presents some distinct characteristics that differentiate this shipping segment largely from the deep sea segments, like the containerships, the tankers, the general cargo carriers (Woxenius, 2012).

The purpose of this paper is to investigate the purchasing chain of RoRo shipping services and identify the determinants that have impact on its competitiveness. Given the fact that RoRo shipping faces a strong competition from land-based modes of transport and the supply of RoRo services is strongly influenced by the shippers' demands, this paper's results could assist

the efforts for the further employment of this maritime segment and its integration into efficient sustainable logistic chains.

Methodology

In order to examine the purchasing and supply aspects of RoRo shipping services and identify the main factors that have impact on the competitiveness of RoRo vessels operations, a thorough literature review was conducted and a taxonomy of these determinants was developed. Given that the literature body on RoRo shipping demand is limited, purchasing and transport mode selection literature were also examined and the data were tailored to reflect the determinant factors for the employment of RoRo shipping services. The factors are categorized into eleven groups: (i) economic factors, (ii) timing factors, (iii) service quality factors, (iv) cargo related factors, (v) environmental factors, (vi) marketing factors, (vii) geographical factors, (viii) technological factors, (ix) safety factors, (x) 'cultural' factors and (xi) port factors. This taxonomy enables the identification of the determinants that impact the competitiveness of RoRo shipping, highlights the interactions among these factors and gives an insight of the possible policies and incentives that could lead to the further use of this maritime segment and its effective integration into intermodal transport chains.

Purchasing of transport services

In order to identify the determinants that affect the competitiveness of RoRo shipping services, the purchasing process of freight transport services is analysed with a special focus on the factors that influence transport mode choice for shippers and freight suppliers. According to Kraljic (1983), the purchasing process of products or services includes four phases: the classification of all purchased services with regard to profit impact and supply risk (Kraljic's matrix), the analysis of the supply market for these services, the identification of the strategic supply services and the design of strategies and action plans. Andersson and Norrman (2002) argue that the purchasing of more advanced logistics services shares similar characteristics with the purchasing process for physical products, but the complexity and the development of some logistics services tend to position them in more strategic decisions. Several authors have mentioned the influence of different contextual variables on the purchasing process of freight transport services, focusing on the heterogeneity of these services and the benefits for shippers from the integration of their transport activities (Hedvall et al., 2017; Rogerson et al., 2014).

The second phase of Kraljic's approach – the analysis of the supply market for transport services - is directly linked to the scope of this paper and is related to the decision process for transport mode selection. Many articles have dealt with the factors that influence the transport mode choice, as this is a quite complicated issue and the interactions of various parameters need to be taken into consideration (Cullinane and Toy, 2000; Flodén et al., 2017; Loetveit Pedersen and Gray, 1998; Meixell and Norbis, 2008); Murphy and Hall, 1995). There is a large differentiation in the way these factors are classified in the purchasing literature, while the relative importance of different factors has changed over the years. McGinnis (1989) made a comparative evaluation of freight transportation choice models and suggested that transport mode choice results from an array of interactions among freight rates, reliability, transit time, loss and damage experience, shipper market needs, carrier capabilities and product characteristics. According to his findings, many of these factors vary among shippers. An understanding of the variables associated with the employment of a specific mode in addition to a thorough analysis of the shippers' needs would help carriers gain a competitive advantage in the market. Liberatore and Miller (1995) classified the transport mode selection criteria in

6 clusters - perceived quality of customer service, shipment tracking and tracing services, electronic data interchange (EDI) capabilities, potential to develop mutually beneficial long-term partnership, cargo capacity limitations of the carrier and the total costs of shipping – and pointed out that the decision for transport mode choice is based on the trade-offs of these variables. Cullinane and Toy (2000) identified the five most common factor categories in the transport mode choice literature as well as their relative importance: cost/price/rate, speed, transit time reliability, characteristics of the goods and service (specific service characteristics). Most recent scientific articles have underlined the importance of environmental considerations in the purchasing process of transport services (Evangelista, 2014; Lammgård and Andersson, 2014; Large et al., 2013). Danielis et al. (2005) highlighted a strong preference of logistics managers for freight service attributes of quality (time, reliability, and safety), in contrast to findings of previous research works, where the cost was the predominant factor for transport mode selection.

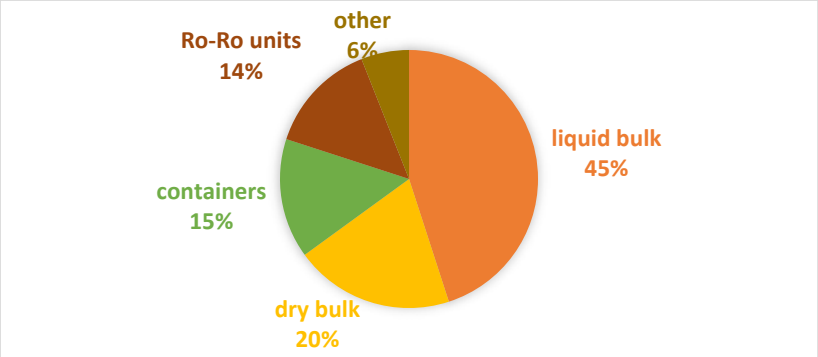
RoRo shipping features

Coming to the purchasing process of RoRo shipping services, which is the focus of this paper, a short description of this shipping sector is necessary in order to give some insight in the specific features of this transport mode and the way this market is structured. Maritime transportation is divided in various segments that present substantial differences in their operations as well as their market structure (Stopford, 2009). RoRo shipping is largely differentiated from the other maritime segments due to its elasticity of demand that is much higher than the other segments, as it faces a strong competition from land-based modes of transport. RoRo shipping suppliers constantly seek to satisfy shippers' needs and their supply of RoRo services is strongly influenced by the shippers' demands that 'define' its operations. In general, RoRo services are similar to liner services where frequent, scheduled and customary seaborne transport services are offered between predestined ports of call.

The topography of countries or geographical areas represents a determinant factor for the use of RoRo shipping. Long coastlines in addition to industrial and production centers located near the coast provide RoRo shipping with a geographical advantage over other modes of transport and thereby facilitate the transport of certain cargoes by RoRo vessels (Paixão and Marlow, 2002). Apart from the geographical position of a country or region, the type of cargoes imported and exported may favor the use of RoRo shipping in relation to other shipping segments. Automobile industry, manufacturers of paper and paper products, electric equipment industries as well as imports and exports of food and drinks are some of the major shippers in the RoRo shipping market.

RoRo shipping – as part of SSS - represents an environmentally-friendly, energy-efficient and safe alternative to road transport that can facilitate the connection of remote and peripheral regions cost-effectively, as it does not require high infrastructure investments (Blonk, 1994). RoRo vessels are characterized as horizontally-loading vessels, as their cargo can be towed into the vessel or brought in on wheeled vehicles, without requiring any special equipment. This characteristic of RoRo shipping enhances its competitive advantage as well as its potential for a modal shift in Europe, as it implies low logistics costs and fast cargo handling (Medda and Trujillo, 2010). The shortsea RoRo shipping segment plays a significant role in the European seaborne trade, accounting for 14% of the total short sea shipping of goods to and from main EU ports in 2015 (figure 1).

Figure 1. Short Sea Shipping (SSS) of goods by type of cargo in 2015 (% gross weight of goods in Mio tonnes)



Source: Own elaboration based on data from Eurostat, 2017

However, RoRo operations require large cargo volumes and high frequency of departures in order to be economically feasible due to the high construction and operational cost of RoRo vessels and 'their inevitably lower load factor compared with containerships' (Casaca and Marlow, 2007). Adequate cargo volumes that 'guarantee' high frequency of departures for the shippers and high capacity utilization for the shipping companies are both vital for the economic feasibility of the RoRo services (Styhre, 2009). According to Ng (2009), 'reasonable frequency, regularity and interoperability between land and maritime components' represents a key factor for the competitiveness of SSS. In addition to the economical parameter, efficient RoRo logistics operations require a 'cultural' change from the side of both the shipowners and the shippers on the basis of the complementarity of inland and maritime carriers' operations (Zachcial, 2001).

The crucial role of ports for the establishment and successful operation of intermodal RoRo services in addition to the importance of adequate port infrastructure for the development of efficient maritime transport chains have been mentioned in various articles (Ng et al., 2013; Song and Panayides, 2008; Suarez-Aleman et al., 2015). Good intermodal connections between ports and inland transport networks are essential for the employment of RoRo shipping, as RoRo shipping suppliers usually do not offer door-to-door services and maritime RoRo transport consists part of an intermodal transport chain that requires sufficient connecting links to inland port infrastructure (Casaca and Marlow, 2009).

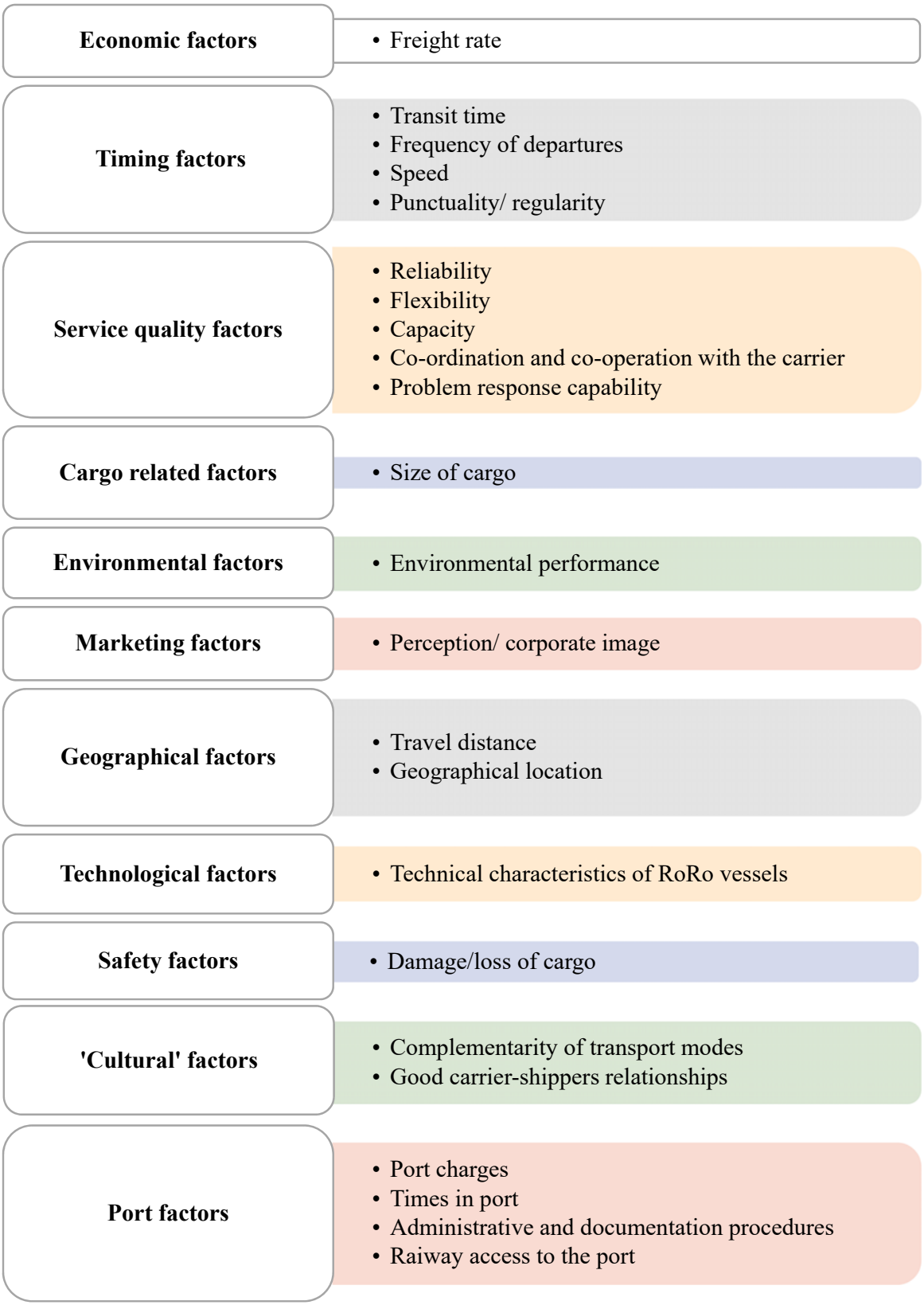
A taxonomy of determinant factors in the purchasing process of RoRo shipping services

After the identification of various factors influencing the purchasing process of RoRo shipping services, a taxonomy of these determinants is developed. The factors are categorized in eleven groups: (i) economic factors, (ii) timing factors, (iii) service quality factors, (iv) cargo related factors, (v) environmental factors, (vi) marketing factors, (vii) geographical factors, (viii) technological factors, (ix) safety factors, (x) 'cultural' factors and (xi) port factors (fig. 2).

(i) Economic factors

Cost is a predominant factor in the decision process for transport mode selection, but its ranking differs according to the contextual variables of freight transport services. Previous studies highlighted cost as the most important factor for the selection of transport mode, but in most recent articles it is ranked below service quality and/or timing factors (Brooks and Trifts, 2008;

Figure 2. Determinant factors in the purchasing process of RoRo shipping services



Source: Own elaboration

Casaca and Marlow, 2005; Cullinane and Toy, 2000; D'Este and Meyrick, 1992; Danielis et al., 2005; Flodén et al., 2017; Loetveit Pedersen and Gray, 1998; McGinnis, 1989; Meixell and Norbis, 2008). For RoRo shipping services, cost is an important parameter, but its ranking depends on the value of the transported cargo. For low value cargoes, where the transportation cost stands for a relative large part of the total production cost, cost is ranked as the most important factor in the transport mode selection process.

(ii) Timing factors

RoRo shipping competitiveness is largely affected by the regularity/punctuality and frequency of departures, as shippers require frequent, scheduled and customary seaborne transport services between predestined ports of call for the satisfaction of their transportation needs (Casaca and Marlow, 2007; Ng, 2009; Styhre, 2009). Transit time and speed are significant factors for RoRo shipping services, strongly interrelated to the value/perishability of the cargo (Brooks and Trifts, 2008; Casaca and Marlow, 2005; D'Este and Meyrick, 1992).

(iii) Service quality factors

Reliability is a crucial factor for the selection of RoRo shipping services, ranked high in the whole body of transport mode literature (Brooks and Trifts, 2008; Casaca and Marlow, 2005; Cullinane and Toy, 2000; D'Este and Meyrick, 1992; Danielis et al., 2005; Flodén et al., 2017; Loetveit Pedersen and Gray, 1998; McGinnis, 1989). Capacity is an important factor for the competitiveness of RoRo shipping services, ranked much higher than in other transport modes. High capacity utilization is vital for the economic feasibility of the RoRo services, but it implies the probability of capacity shortage – 'bottleneck' – in peak periods (Kraljic, 1983; Styhre, 2009). The flexibility and problem response capability of the RoRo service provider – ability to handle special consignments or urgent deliveries – as well as the good coordination and cooperation between shipper and carrier are determinant factors for efficient RoRo shipping services. Many RoRo vessels are time chartered for long periods and 'committed' to specific trade routes through long-terms contracts, leading to the formation of long-term partnerships (Casaca and Marlow, 2005; D'Este and Meyrick, 1992; Liberatore and Miller, 1995; Loetveit Pedersen and Gray, 1998).

(iv) Cargo related factors

The weight or size of the cargo is a determinant factor for the employment of RoRo shipping, as cargo needs to be towed into the RoRo vessel or brought in on wheeled vehicles and therefor is subject to certain restrictions. The value and perishability of the cargo is negatively related to the use of slow transportation modes, but it does not seem to affect the choice for RoRo shipping services (Ng, 2009). Automobile and forestry industry are both major shippers in the Swedish RoRo shipping market, whereas the value of their transported cargo is totally different.

(v) Environmental factors

RoRo shipping represents an environmentally-friendly, energy-efficient and safe alternative to road transport and its environmental performance is one of its major assets (Blonk, 1994). The fact that environment is ranked high in recent transport mode literature suggests that RoRo shipping competitiveness is strengthened from its environmental performance (Flodén et al., 2017; Lammgård and Andersson, 2014).

(vi) Marketing factors

The market perception and corporate image of RoRo shipping services affects the competitiveness of this transport mode and its 'reputation' needs to be improved for the achievement of its further employment (Blonk, 1994; Casaca and Marlow, 2005).

(vii) Geographical factors

Travel distance and geographical location can favour the employment of RoRo shipping services. There is a distance range within which RoRo shipping can successfully compete with land-based modes of transport; short distances (<700 kms) are dominated by road transportation (Brooks and Trifts, 2008; Jiang et al., 1999). Long coastlines in addition to industrial and production centers located near the coast provide RoRo shipping with a geographical advantage over other modes of transport and thereby facilitate the transport of certain cargoes by RoRo vessels (Paixão and Marlow, 2002).

(viii) Technological factors

The technical characteristics of the RoRo vessels have some influence on the competitiveness of RoRo shipping services, as several RoRo vessels are purpose built - predestined to be employed in specific trades and routes – and possess beneficial technical features that add value to their transport services (D'Este and Meyrick, 1992).

(ix) Safety factors

The damage/loss of cargo is a determinant factor affecting the competitiveness of RoRo shipping, mentioned in many research articles (D'Este and Meyrick, 1992; Danielis et al., 2005; Flodén et al., 2017; Loetveit Pedersen and Gray, 1998; McGinnis, 1989).

(x) 'Cultural' factors

The development of a management 'culture' that promotes the complementarity of different transport modes and relies on carriers-shippers' relationships can have significant impact on the further employment of RoRo shipping services, as these services usually do not offer door-to-door transportation, but consist part of an intermodal transport chain (Casaca and Marlow, 2009; Zachial, 2001).

(xi) Port factors

Efficient port operations are essential for the employment of RoRo shipping. High port charges and long times in ports in addition to complex administrative and documentation procedures can influence negatively the competitiveness and feasibility of intermodal RoRo services (Ng et al, 2013; Suarez-Aleman et al., 2015). The access of railways to the port is a determinant factor for the use of RoRo vessels for the transportation of certain cargoes (D'Este and Meyrick, 1992). The transportation of Swedish forest products consists an example of these cargoes, where intermodal logistics chains have been developed, combining rail and RoRo shipping.

Discussion and conclusion

RoRo vessels represent one of the main categories of the SSS market that offer the potential for a modal shift in Europe due to their technical characteristics - horizontal handling of RoRo units – that imply low logistics costs and fast cargo handling, essential for the enhancement of the competitiveness of SSS. RoRo services face a strong competition from land-based modes

of transport and their elasticity of demand is quite high, which implies that RoRo service providers need to have a good knowledge of their shippers' needs and adjust accordingly their operations. Throughout this paper, the determinant factors that influence the employment of RoRo shipping services are analysed and categorized in order to highlight the interactions among the valued service qualities that derive from shippers' requirements in the transport mode selection process.

Identified key determinants for the employment of RoRo shipping services are reliability, price, frequency of departures, flexibility, transit time, regularity, damage/loss of the cargo, problem response capability. Apart from these factors that are common for any transport mode, RoRo shipping demand is strongly influenced by capacity utilization, cargo characteristics and travel distance. The environmental performance of RoRo shipping is one of its main assets and should be promoted by the RoRo shipping providers as environment is ranked high in recent transport mode literature and this factor strengthens the competitiveness of RoRo shipping services. The corporate image of RoRo shipping needs to be improved for the achievement of its further employment.

The integration of RoRo shipping services in intermodal transport chains represents the greatest challenge for the enhancement of the competitiveness of this transport mode and it is dominated by 'cultural' and port-related factors. A different management approach and 'culture' that rely on carriers-shippers' relationships and are based on the complementarity of different transport modes' operations need to be developed. The competitiveness and feasibility of RoRo shipping services are strongly influenced by the port operations. Ports serve as 'nodes' in an intermodal transport chain and their efficient operations – low port costs, short times in ports, simplification of administrative and documentation procedures – are vital for the establishment of successful intermodal RoRo services.

This paper's results could contribute to the identification of the best performing policies and incentives for the further employment of this maritime segment and its integration into efficient sustainable logistic chains. In future, empirical research among Swedish shippers will be conducted to map their attitudes towards RoRo shipping services.

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Innovated outside: examining precedents to purchasing's contribution to innovation exploration

François Constant[1], Thomas E. Johnsen[2]
[1]PhD candidate, Politecnico di Milano School of Management, email: constant.francois@polimi.it
[2]Politecnico di Milano School of Management, email: thomaserik.johnsen@polimi.it

Abstract
This study investigates motivations and capabilities that are necessary to the purchasing function for contributing to innovation exploration, under high technological and market uncertainty. Drawing upon dynamic capability and cognitive theories, we use the awareness-motivation-capability (AMC) framework to examine innovation exploration as a process in which purchasing can contribute to enhance firms' innovation capabilities. We report on two in-depth case studies through 28 semi-structured interviews. The findings highlight four necessary factors that facilitate purchasing's contribution to innovation exploration. Our study provides a contribution to purchasing literature, and has implications for managers intending to shape, adapt or redesign their purchasing organizations to better explore innovations.

1. INTRODUCTION

There is a growing interest in the role purchasing can play in sourcing organisational and technological capabilities (Spina, Caniato, Luzzini and Ronchi, 2013). West and Bogers (2014) even suggest that sourcing innovation from external sources can create a competitive advantage. As companies concentrate more and more on their core business, their ability to "innovate outside" is important, and sourcing innovation from external partners is becoming a key success factor (Narasimhan and Narayanan, 2013). Although it is often in charge of external resources management, purchasing is traditionally not regarded as a key contributor in the innovation process (Melander, 2014). Despite its usual responsibility for sourcing, purchasing also is not seen as a key contributor in innovation exploration (Gualandris et al., 2018), as it is commonly accepted that R&D has the premium role as innovation provider. The role of purchasing in exploring new sources of innovation has been investigated mainly in the context of New Product Development (NPD), linking innovation capabilities and purchasing involvement in the NPD process (Van Echtelt, Wynstra, Van Weele and Duysters, 2008), typically characterized by low technological uncertainty.

Exploration in the context of high technological uncertainty is about finding external capabilities, which are new to the firm, and outside the existing supply network. We rely on the definition of an innovation as "an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention" (Garcia and Calantone, 2002). Under high technological uncertainty, firms may scout for innovations which are not available within the focal firm's existing environment (Melander, 2014; Narasimhan and Narayanan, 2013). This calls for the notion of "distance" in the supply network (Phillips, Lamming, Bessant and Noke, 2006). In this case, exploration involves distant search for new capabilities, bringing opportunities to the firm in achieving new-to-the-world innovations (Nerkar and Roberts, 2004). Exploring innovations within new markets and technologies implies evolving in higher uncertainty and higher risks (O'Connor and Rice, 2013). To succeed in managing within a highly uncertainty context, companies need to develop new capabilities i.e. to make changes in their strategies, organizational structures, processes,

management resources and culture (Slater, Mohr and Sengupta, 2014). In uncertain environments, organizations need to modify their approach to source innovation with flexibility which may call for a new role of purchasing function and the creation of new linkages with other functions (Narasimhan and Narayanan, 2013). Despite the traditional passive role of purchasing in innovation exploration, the latest research suggests that purchasing can in fact play a key role in this process (Gualandris et al., 2018). But the understanding of these changes at the purchasing function level is still limited.

We build on the dynamic capability theory, providing that an innovation can be developped from outside the firm (Teece, David, Pisano and Shuen, 1997), in other words, it can be "innovated outside". We use also the Awareness-Motivation-Capabilities (AMC) framework which helps to identify business cooperation and behavioural drivers in an organization (Chen and Miller, 2015; Chen, 1996). AMC framework has rarely been used in purchasing field (Schweig, 2015) but provides an interesting frame to analyse cognition and behavioural causes, which complete the traditional drivers found in business management and purchasing theories. Simply stated, purchasing will not be able to explore innovation unless it is Aware of the innovation, Motivated to explore innovations, and Capable of exploring outside the firm. Adapting the AMC framework, we argue that purchasing contribution to innovation exploration will be driven contingently by *purchasing's awareness* (defined as the accessibility to the innovation and purchasing's visibility), *purchasing's motivations* to explore innovation (related to incentives, intrinsic and extrinsic motivations to explore innovation), *purchasing's capabilities* (depending on firm resources, experience and practice, as well as resource-rich supply environment).

Our aim is to investigate the drivers and capabilities fostering purchasing's contribution to innovation exploration and how technological and market uncertainty moderate these drivers. We pose the following three research questions:

1. *How is purchasing made aware of innovation opportunities?*
2. *What motivates purchasing to explore technological innovation?*
3. *Which capabilities are required to make purchasing contributing to innovation exploration?*

We have done two in-depth case studies and conducted 28 semi-structured interviews in two firms from the same innovation-intensive sector. After having analysed the data we collected, we suggest that four factors are necessary to facilitate purchasing's contribution to innovation exploration: 1/ Purchasing awareness of an innovation is facilitated by purchasing integration into Business Development knowledge, in addition to the integration into R&D 2/ Purchasing's motivation to innovation exploration come mainly from extrinsic incentives (technological shift in the market) 3/ A specific purchasing unit dedicated to exploration tasks full time is a core capability 4/ Skilled resources, such as purchasers' culture, experience and creativity are key factors influencing innovation exploration capabilities. This article report on the theoretical background of our research, our methodology and our findings (within-case and cross-case finding). It provides a contribution to purchasing literature, and has implications for managers intending to shape, adapt or redesign their purchasing organizations to better explore innovations.

2 - LITERATURE REVIEW

2.1. Exploration from a dynamic capability perspective: Dynamic capability (DC) theory can put light on issues related to innovation and knowledge transfer (Weeks, 2009). DC are the "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environment" (Teece et al, 1997). DC approach takes its main advantage compared to other theories in the process of *capability development* (firms can develop or acquire a capability which will provide a competitive advantage), providing that an innovation can be acquired from outside the firm (Teece et al, 1997). This is a concrete attribute of DC

theory, which opens broadly the possible investigations of its application to purchasing field. Managing relationships with suppliers (referring to concepts like communication, integration, coordination) can be considered a dynamic capability itself (Spina et al, 2016): "Both capabilities on the supplier and the buyer side can be studied as a source of competitive advantage". Contributing to firm's innovativeness through sourcing relationship is also considered as a dynamic capability in the literature (Weeks, 2009).

Although DC theory is relevant in external source acquisition, it does not refer to any degree of uncertainty. Literature suggests DC is about changes in resource base via routines, processes and capabilities: "dynamic" is a word calling for the study of firms' adaptation, and wet think it is valid to investigate a fast-paced and ever-changing environment, i.e. a context of high technological and market uncertainty, where exploration becomes necessary. It is therefore valuable to describe DC as a result of firm's constant adaptation, but Teece's (1997) paper is not clear on how firms should adapt over time. It does not explain the transformation path firms should follow with these resources (how they proceed), neither presents factors other than capabilities which could influence firms' performance (i.e. other drivers). For instance, it is unclear how resources, routines, assets, capabilities and knowledge relate to dynamic capabilities and how managers can make good strategic decision based on this theory. DC authors say that performance result from organizational capabilities developed by individual organizations, but they should define the term capabilities in a more precise way, focusing for instance on resource transformation process itself, and other factors such as motivations. For this reason, and to increase managerial implications of our research, we need to complement DC with another theoretical frame.

2.2. Awareness Motivation Capabilities framework: The Awareness, Motivations and Capability (AMC) framework derives from cognitive science and is now part of the strategic management field. AMC relies on cognitive components to explain why an action occurs. The AMC concept has first been used to investigate the interfirm tensions and competitive dynamics (Chen, 1996). Chen and Miller (2015) propose that AMC framework might support the understanding of reasons, sources, concerns and consequences of cooperative actions (Chen & Miller, 2015). It analyses "the extent of awareness, the level of motivation, and, finally, the capability to respond" (Livengood and Reger, 2010). The AMC framework is advocated to be a powerful tool in the field of strategic management for highlighting behavioural drivers of competitive dynamics but also cooperation. Cooperation is of interest for us, because it refers to relation and decision among business partners (Gnyawali and Madhavan, 2006). Innovation can be a result of a cooperation between customers and suppliers and partnering in an innovation can be considered as business cooperation (Schiele, 2010). Awareness is initially defined as the accessibility to knowledge from firm's rivals and its competitive environment; motivation is about firm's willingness to react and respond to competitor's actions, and capability represents firm's resources to move and take a competitive decision (Chen, Kuo-Hsien and Tsai, 2007). "Awareness and motivation are conditioned mainly by market relationships, and capability depends largely on strategic or resource endowments" (Chen, 1996). The AMC framework has been applied recently to study the perceived and objective relationship between companies (Chen et al., 2007; Chen and Miller, 2015). The relational approach, defined by Chen and Miller (2015) explains how firms' competitive advantages might be enhanced by increasing collaboration with partners to develop core competencies (Brandenburger and Nalebuff, 1996). This stream of research emphasizes the need to build upon supplier's cooperation (Markman, Gianiodis and Buchholtz, 2009) "to build up core capabilities and increase cooperative network" (Chen et al, 2015). In the relational approach, the AMC framework has a specific shape where cooperation is moderated by organization type and industry culture. A few scholars have linked the AMC framework with supply chain management (Schweig, 2015). According to the recent usage of the AMC framework focusing on cooperative decisions (Chen

et al, 2015), this model is relevant because we can adapt it to investigate how purchasing adapt its awareness, motivations and capabilities to better contribute to innovation exploration.

2.3. Innovation exploration: Exploration involves scouting for unfamiliar, distant and remote knowledge (Ahuja and Lampert, 2001; Rosenkopf and Nerkar, 2001; Nerkar, 2003). Innovation exploration refers to scouting innovations outside the existing supply base and calls for distant search for new capabilities, bringing opportunities to the firm in achieving new-to-the-world innovations (Nerkar and Roberts, 2004). Exploration is a managerial opportunity and a critical necessity in a context of technological uncertainty. Exploration "entails a shift away from an organization's current knowledge base and skills" (Lavie, Stettner and Tushman, 2010). Research has demonstrated that the nature of these shifts is related to new technical skills, market expertise, or external relationships (Lavie and Rosenkopf, 2006). Innovation exploration in a context of high technological uncertainty means facing unexpected challenges, tensions, and disillusions. Exploration relates to high degree of uncertainty and involves suppliers that are distant from the incumbent firm: this requires working with new markets, new routes of sourcing and innovations which bring higher uncertainty and risk (O'Connor and Rice, 2013). Explorers need to manage unanticipated obstacles, learn a lot from what they discover, and have a creative mindset (Day, 1994). This makes it more difficult to keep motivation alive in such a context (Kelley, O'Connor, Neck and Peters, 2011). Exploring supply networks to find innovations is highly demanding because of high uncertainties, unpredictable discoveries. Current literature has reported a lack of motivation as an obstacle to innovation in a context of high uncertainty (Alexander and van Knippenberg, 2014). Therefore, understanding drivers of innovation exploration is of high interest, because it is an important component of the innovation exploration success, especially in large firms (Kelley et al, 2011; Stringer, 2000).

2.4. Purchasing contribution to innovation exploration: In most economic models, technological innovation comes from the incumbent firm (Henderson and Clark, 1990; Utterback, 1994), as it is commonly accepted that innovation is supposed to emerge from R&D (Damanpour and Aravind, 2012), especially under high technological uncertainty (Oh and Rhee, 2008). Purchasing is rarely seen as a real technology importer (Melander, 2014). Purchasing can contribute to innovation through exploration within current resources under low-market uncertainty. Through purchasing, companies are aware of suppliers " [...] relatively close in terms of product type, geography, and other salient characteristics" (Peteraf and Bergen, 2003). As a corollary to this assumption, companies tend to ignore suppliers who are more distant from them in terms of product type, geography and other knowledge (Livengood and Reger, 2010) which is a characteristic of technological and market uncertainty. This is typically the role of purchasing when it is involved early in NPD, as it is expected to source suppliers capable to execute innovations designed internally.

However, new research suggests that purchasing can be involved in innovation acquisition from external suppliers (Henke and Zhang, 2010), can facilitate involvement and collaboration with suppliers early in the NPD process to benefit from the joint R&D (Johnsen, 2009; Patrucco, Luzzini, and Ronchi, 2017), or can use open innovation practices within buyer-supplier relationship to leverage external sources of innovation (West and Bogers, 2014). There is a growing trend towards the consideration of purchasing involvement in innovation sourcing (Spina et al., 2013), where sourcing involves external suppliers which are considered as sources of innovation and competitive advantage (West and Bogers, 2014; Li and Vanhaverbeke, 2009; Schiele, 2010; Narasimhan, 2013; Lau, Tang and Yam, 2010, Grimpe and Sofka, 2009). According to a few scholars, purchasing is therefore well placed to contribute to innovation exploration (Narasimhan and Narayanan, 2013).

2.5. Purchasing Awareness of an innovation: Awareness is defined as the accessibility to a knowledge (Chen et al., 2007) and is conditioned mainly by market relationship (Chen, 1996). We define purchasing awareness as purchasing capability to be aware of (detect, identify) an innovation "designed outside" or any external knowledge: here knowledge concerns suppliers'

innovation. If purchasing is aware of a source of innovation within the extended supply network, then it can decide whether to act or not to study this innovation deeper in details, or to leave the opportunity aside. Also, purchasing awareness may concern the need to find external knowledge to develop an innovation "designed inside", for which the firm wants to outsource the execution and search for a supplier. In a context of rivalry, the literature reports that awareness drivers include action visibility and firm size (Chen and Miller, 1994). We argue that awareness enables purchasing contribution to innovation exploration: purchasing will increase its contribution to innovation exploration once it increases its market visibility. Awareness is also about *visibility*: purchasing has a better visibility on the supply market by increasing supplier integration (Ragatz, Handfield and Petersen, 2002; Petersen, Handfield and Ragatz, 2005). Supplier integration includes the timing of supplier involvement in a new program, the degree of supplier design responsibility, and the frequency of buyer/supplier communication (Hartley, Zirger and Kamath 1997). Firm size may increase action visibility (Chen & Miller, 1994), and applied to purchasing this means better market knowledge. Purchasing integration also enables the awareness of innovations needs. Also, accessibility to external knowledge depends on the structure of the organization: literature highlights that the structure of firm's organization may influence its performance about explorative tasks (Boumgarden, Nickerson and Zenger, 2012).

2.5. Purchasing motivations and capabilities fostering innovation exploration:

Purchasing Motivation: Innovation development under high uncertainty is a process which depends on motivation (Alexander and van Knippenberg, 2014). Motivation here refers to drivers fostering an action and calling for the acquisition and use of specific skills and abilities (Locke and Latham, 2004). Motivation fosters tasks which enhance innovation performance, such as idea creation, taking initiatives outside traditional firm's barriers. Thus, purchasing motivation represents purchasing's willingness to explore supply networks to detect new sources of innovations, but this requires specific skills and abilities. "Motivating innovation" is an important concern in many incentive problems (Manso, 2011). Motivation theory helps to define motivational drivers and to narrow down to specific drivers that purchasing may encounter to increase its contribution to innovation exploration. Pihlajamaa (2017) has suggested purchasing key motivations to explore innovations in a context of high uncertainty: motivations may come from the setting of moderately challenging goals assignment, and moderately specific goals. He reported that conflicting goals may decrease motivation for innovation (Pihlajamaa, 2017). Explicit incentives, such as bonuses and rewards, may push purchasing to create market opportunities to source innovation (Amabile, Conti, Coon, Lazenby and Herron, 1996). Purchasing can explore to gain better visibility of the supply network (Ragatz et al, 2002) or to increase firm visibility (Chen and Miller, 1994). A recent study suggests that rewards are critically important especially high with uncertainty context (Sergeeva, 2015). Motivation to explore can be also exacerbated by the territorial interests in different markets (Gimeno, 1999), or cost reduction targets. Obtaining or sharing the rights to use the innovation patent may increase purchasing motivation, as well as the wish to capture long-term relationship with the supplier. We rely on the influence of "innovation champions", i.e. managers intensely interested in new ideas, who spread enthusiasm to other employees and facilitate the development process (Gemünden, Salomo and Hölzle, 2007). Attitude towards risk taking and creativity is widely influenced by organizational culture in a context of high technological uncertainty (Slater et al., 2014; O'Connor and Ayers, 2005). Organizational culture is made of concepts, values and beliefs in a company (Schein, 2010). A motivating culture does not only tolerate risk taking but encourage it, accept failures (Kyriakopoulos, Hughes and Hughes, 2016) and allow individual to try their ideas (Green and Cluley, 2014). Also, companies whose governance and culture build on long-term view will promote relational approach with suppliers rather than rivalrous competition (Chen and Miller, 2015). This will enhance motivation to build relationship with suppliers.

Purchasing Capability: Recent studies have begun to explore core purchasing capabilities to succeed on innovation sourcing: gathering unmet needs, involving suppliers in innovation projects, exploring external opportunities (Legenvre and Gualandris, 2017). We believe we can go further in determining multilevel core capabilities supporting purchasing's contribution to innovation exploration. Core capabilities are "a set of differentiated skills, complementary assets, and routines that provide the basis for a firm's competitive capacities and sustainable advantage in a particular business" (Teece, Pisano and Shuen, 1990). This definition emphasises the study of core capabilities at organizational (firm), which includes employee knowledge and skills, processes and managerial systems (Leonard-Barton, 1992). Other scholars consider that exploring a rich business environment is also a capability (Chen and Miller, 2015). At a functional level, the literature identifies core and non-core competencies or capabilities for purchasing professionals. Any function has a limited set of capabilities, representing "a collection of knowledge, skills, abilities, and other characteristics that are needed for effective performance in the jobs in question" (Campion, Fink, Ruggeberg, Carr, Phillips and Odman, 2011). A capability relates to the execution difficulty and information processing (Smith, Grimm, Gannon, & Chen, 1991). We use the following definition of purchasing capabilities: "Purchase-related capabilities may be defined on two dimensions: (1) capabilities related to the assimilation and dissemination of information on suppliers and markets and (2) relationship-building capabilities" (Quintens, Pauwels and Matthyssens, 2006). Relationship-building capabilities are relevant when considering close partnerships on new product development and innovation (Cavusgil and Zou, 1994). Chen (1996) further argues that a capability "depends largely on strategic or resource endowments", which calls for the consideration of purchasing budget and policies for innovation search (Pihlajamaa, 2017). Corporate culture seems also to be a relevant driver (Narasimhan and Narayanan, 2013). Table 1 represents AMC framework adapted to purchasing, and table 2 report on A, M, C themes and sub-themes found in the literature. Fig 1 presents our theoretical model that respects the theoretical foundation found in the literature :

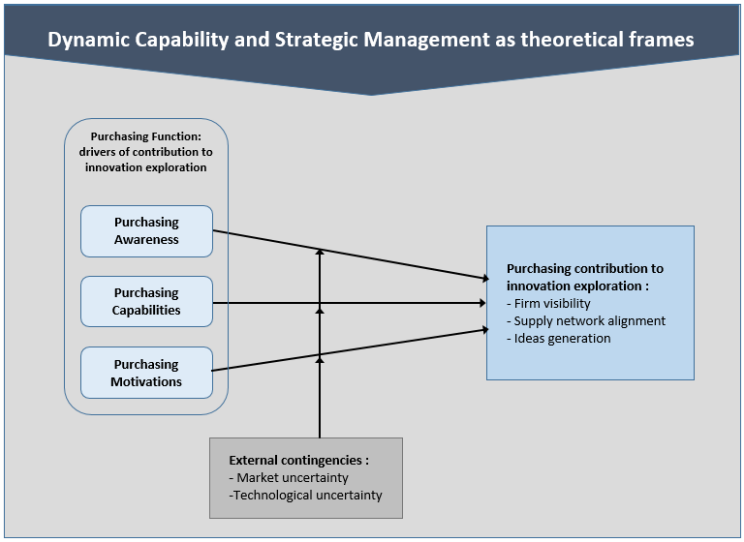

Fig 1: Theoretical model

4 - RESEARCH METHODOLOGY

4.1. Case presentation: We aim at answering the questions: *How is purchasing made aware of innovation opportunities? What drives purchasing to explore technological innovation? Which capabilities are required to make purchasing contributing to innovation exploration?* We have selected two cases replicating current research about purchasing involvement in innovation

exploration, i.e. two companies which have already started to involve purchasing innovation exploration process (Table 3). These cases were chosen because of the similar nature of their businesses (industrial but innovation intensive), the firm sizes (the two firms have very different sizes, ratio x20) and their maturity degree (a-priori different). Moreover, we selected two companies where the specific outcome of our planned research occurs, which is not an easy task nowadays because few companies started to bridge purchasing and innovation exploration. We follow Pettigrew (1992), who suggested that it makes sense to select such rare cases where the process of interest is "transparently observable", not to say exacerbated. In-depth case studies "capture the dynamics of a studied phenomenon and provide a multidimensional view of the situation in a specific context" (Järvensivu and Törnroos, 2009). Our unit of analysis is the organization, where the purchasing function is the centre of an internal network, i.e. other functions within the firm. We focus therefore on organization-level factors, excluding suppliers themselves: studying buyer-supplier relationships is out of our scope because it might force to extend the data collection to supplier' perspective on the topic (i.e. interview them), while we want to capture within-purchasing firm perception. Table 3 presents the two firms.

a) **Company SE Corp overview**: SE Corp is an international group, worldwide leader in connected solutions for building, infrastructures and industry. The company is deeply oriented towards innovation and technological progress. Purchasing department is deeply involved in the process of innovation exploration. Purchasing's contribution to explore innovation is good: 35% of the total innovation "sourced externally" came from purchasing. This exceptional maturity is rare. However, involving purchasing in innovation exploration is a recent change at SE Corp. Until recent years, SE Corp considered innovations should come only from inside the firm (R&D). This strong culture is still present in the company, but has started to change, while innovations coming from outside are more and more considered as valuable. Thus, two years ago, SE Corp has implemented a specific function "purchasing innovation", independent from the rest of the purchasing department (purchasing operations, projects and category management) but reporting to the Chief Purchasing Officer. This entity remains small (5 people full time) compared to the rest of purchasing department (1800 people in total), but has functional management on about 50 people inside or outside purchasing department. This team keep listening to the market to detect any innovation which could be valuable for their firm, and manage innovation exploration as full-time jobs. On a corporate level, SE Corp culture is oriented to long-term views where innovation is a priority.

b) **Company DD Corp overview**: This family-owned company designs, manufactures and sells electronic products for home applications and buildings. In 2013, the managing director has decided to nominate R&D director at the head of purchasing department. This move has been full of signification: the idea behind was to benefit from this organisation change to ask purchasing to be involved more in R&D, and vice-versa. Purchasing started seeking to innovation exploration but without clear success yet. DD Corp suffered from a management in "silos", where a strong "designed-inside" culture is still spread among departments. Today, DD Corp faces drastic changes in its core market, forcing to adopt new technologies which are not well known inside, such as cloud services and iOt, whereas traditionally DD Corp use to manage low-service procurement (electrical and mechanical components). R&D has still a strong position, whereas purchasing is challenged to adapt and to shift the paradigm in sourcing, but this is far to be a success They have implemented another department supporting innovation, Research and Innovation (R&I), which is in charge of providing inputs about technological changes an pushing new demands to purchasing. Purchasing is therefore more an executant than an importer of the innovations although DD Corp has understood the opportunity to get complementary assets from suppliers.

4.2. Data collection: We interviewed 28 people in total (18 at SE Corp and 10 at DD Corp) and multiple stakeholders from various departments in each firm: purchasing department (various hierarchical positions from director's level to operational, but also each function with

purchasing department: project purchasing, category purchasing, innovation purchasing), other departments (R&D, business development, R&I i.e. Research and Innovation). We asked questions about macro-level (firm environment), within-firm level and individual level to increase the deepness of the observations. These multiple angles of observation create rich findings and support "the vital understanding of complex business relationships" (Dubois and Araujo, 2007). Although we do not claim triangulation, we have collected secondary data about both companies, from the web, annual report and industry associations, to complete the primary data. Table 4 presents the interview plan. We adopted active interviewing methodology, which treat the interview as a social experience in which knowledge is jointly created by the interviewer and the interviewee (Holstein and Gubrium, 2004). The interviews were semi-structured: the topic was fixed but the scope was relatively broad, focus on processes and events. We designed three types of interview guides, to adapt the questions to the interviewees' profile. The aim of this distinction was to develop a 360° overview of the topic, considering the assumption that people belonging to a specific function may not have the entire understanding of capabilities needed to succeed in this function.

During the interview phase, we asked how the measurement of purchasing contribution to innovation is made. Counting contribution to innovation is not easy, it is even more difficult when we want to link innovation exploration to commercial success or profit impact. Patents acquired over a given period is a frequent metric used to measure innovation. There is a substantial micro evidence that patent counts are associated with firm value and industry dynamics (Azoulay and Lerner, 2012). Another metric is to measure R&D expenditures, although Griliches (1990) reviews suggest that patent counts can better explain firm market value even beyond R&D expenditure. In our research, the measure of the contribution is not related to any economic success, but more on the effort to detect (find) the innovation and to communicate it internally. This statement is important to make, otherwise, key outcomes of the process would remain under-examined. We do so, because literature reports that some innovations that are technologically and even economically superior fail to be marketable, or ultimately accepted by customers (Rogers 1995). Assuming that innovation "discovery" is the result of the innovation exploration process, we follow the idea that the success of innovation "discovery" is proportional to "level" of exploration effort (Azoulay and Lerner, 2012). We will therefore measure this effort (i.e. contribution) providing the count of innovations discovered (i.e. by purchasing here). Therefore, the success of overall innovation exploration depends on the quantity of innovations discovered by purchasing. We exclude the quality of the innovation, although there is a clear correlation between quality of the innovation and firm's value (Hall, Jaffe, Trajtenberg, 2005), because it is extremely hard to assess in respect with measurement characteristics as of Jaffe (2008).

4.3. Data analysis: Our aim is to make sense of our empirical data collected during two case studies. We engaged in the process of coding data to make sense of interviews, following DeCuir-Gunby, Marshall and McCulloch (2011). We proceeded to manual data coding to introduce our findings. We did a code-book including theory-driven codes, as well as code coming from the context itself (Ragin, 1997). The aim of the coding process is to identify themes that come repeatedly during the interviews, and to analyse them. Our goal is not to construct a generalizable theory from a positivist perspective but to explore and understand a phenomenon in its specific context. The term "validity" has a different meaning here from the positivist approach (Järvensivu and Törnroos, 2009). Doing two case studies will increase a little bit the generalisability of the findings (Eisenhardt, 1989), and will aim at contributing to a better understanding of the reality in its context, from multiple perspectives. Our research is "authentic and fair" (Lincoln and Guba, 2000), meaning that all stakeholder voices have been heard and considered in the result.

5. WITHIN-CASE STUDY FINDINGS

In this section, we present the findings from each case independently, reporting on purchasing awareness, motivation and capabilities relatively to innovation exploration within each firm.

5.1. Findings within DD Corp

a) DD Corp purchasing awareness*:* At DD Corp, the main source of innovation awareness is the R&I department. Purchasing is able to stay aware of innovation through a joint work with R&I. R&I identifies innovations, and communicates objectives to purchasing through technical datasheets. "*I work a lot with R&I. When we share our views, I can show suppliers' technological road maps, analyse costs and risks, whereas R&I provides feed-back about the potential performance of suppliers' innovations. Purchasing acts as a filter between suppliers and R&I*" (DD Corp Purchasing Director). DD Corp purchasing is still transmitting technical datasheets to suppliers, to source innovation "*if you want to innovate, you need to formalize your needs. Some people here think that we should keep it open. But I think instead that we must pose boundaries to suppliers and formalise: we do innovation like this*" (DD Corp Purchasing Director). Purchasing organizes "tech days" on a yearly basis to stay closer to suppliers' innovations: during these events, current strategic and non-strategic suppliers are invited to come and present their innovations. The aim is to survey the market and innovations. "*We organise this event since 2013, but we hardly succeed to make our [DD Corp employees] staff coming and attend. Even if we insist, even if we impose, it remains very hard to make people join. They always have a good excuse to avoid coming, although suppliers are here with very interesting things to share with us*". Another source of knowledge is made of external service providers, who disclose market studies which are shared internally. DD Corp emphasizes also the use of scientific knowledge, building partnerships with universities through R&D, but this is rarely under purchasing's incentive. Non-regular contacts with innovators during exhibitions, trade shows may also provide opportunities, but this is rare. "*Apart from innovations designed inside that we need to source outside, it remains a coincidence when purchasing discovers an innovation outside and bring it back into the firm, even more rare to make it accepted by internal teams*".

b) DD Corp Purchasing motivations: The main incentive to go and explore innovation in the supply base are related to the need to source new technologies, under the request of R&I. For instance, the traditional set of categories (electronic components, PCB, electro-mechanical components, etc…) are still sourced but purchasing is now expected to source new categories: cloud and data services, integrated software, immaterial products. Purchasing must adapt and build new skills. At the purchasing level, the governance, corporate culture and incentives seem to have little influence on the motivation to explore innovation. The top management has a vision oriented towards technology, in its original meaning of technical development (engineers must develop innovations, not purchasing). For this reason, the mission given by the management to purchasing is limited to traditional sourcing and transactional tasks, thus do not represent an explicit incentive to go and explore innovations. However, innovation sourcing is part of the mission "*Motivation to explore innovation is not a wish, it is part of the mission… It is written in the mission profile, so this is a chance because I am obliged to do it… We have less work to support operations on daily crisis and logistics, but more work to make a technological market survey*" (DD Corp purchasing Director). At the individual level in purchasing, the intrinsic motivation to move naturally towards innovation exploration is limited. Some buyers have personal interests in certain technologies, which helps at transposing ideas found outside into professional knowledge. This personal knowledge is acquired more through personal investigations, interests, readings and participation to social networks, but is limited and is not enough to provide sufficient background to pull an innovation back to the firm. There is no clear track of any positive contribution.

c) DD Corp purchasing capabilities: DD Corp is a smaller company compared to SE Corp, and they cannot develop a specific purchasing team to focus on innovation exploration. *"Due*

to our limited size, we cannot create specific positions focused entirely on innovation exploration. Our buyers use to take a limited portion of their time to stay tuned with the market, but we know it has a limited impact" (DD Corp purchasing Director). Consequently, purchasers struggle at balancing daily tasks and innovation explorations. However, purchasing considers that the richness of firm's supply network is a competitive resource. "A resource-rich environment contributes to provide idea generation" *(DD Corp R&I director),* and they invest time and resources to develop their supply network's capabilities. The ever-changing technological environment makes DD Corp to consider individual technical knowledge as a core capability in purchasing to better contribute to innovation exploration: *« purchasers must have a minimum of technical background, a good understanding of how the firm processes to develop technological innovations. Purchasers must be curious, capable to learn from new technologies in a very fast-changing environment » (DD Corp purchasing Director).*

5.2. Findings within SE Corp.

a) SE Corp purchasing awareness of innovations: At SE Corp, the first source of purchasing awareness comes mainly from purchasing integration to other departments, but surprisingly Business Development function is a better source of awareness than R&D. Purchasing team objective is "*to first understand market needs and R&D needs and then match with the supply network capabilities. Therefore, we have trained our team to talk to R&D, but it also capable to listen to marketing, sales, business units, etc… because we want to pull the knowledge up from the market*". It's a process where a need for an innovation is identified within the customer base (SE Corp calls this "customer pain"), where Business Development teams or marketing identify a "pain" explicitly or implicitly raised up by a customer. Then purchasing is solicited to check whether the supply market can provide an answer to this "pain", and starts exploring. This integration avoids purchasing to explore un-relevant areas and new technologies that do not match with current SE Corp business needs. More than 80% of SE Corp interviewees reported that awareness come mainly from "*the understanding of customer market needs*" rather than "*getting technical demand from R&D*". The reason is that in the past, SE Corp had unsuccessful experiences of innovation sourcing, when purchasing imported too many innovation opportunities but few were *real* marketable innovations. Another mean to be aware of innovation opportunities is R&D, which also detects technological opportunities, listening to the technological market, trade shows, exhibitions and start-up clusters. In that case, purchasing works with the supplier (often a start-up) to carry on putting a contractual frame in the business relationship. Another path of awareness is when SE Corp R&D uses functional datasheets to search for an innovation from the supply base: purchasing transmits the request to suppliers in a form of a functional frame. Thus, purchasing is never left alone to explore innovations: SE Corp clearly emphasize on the integration with business development (to better understand the customer market) and R&D (to get technological inputs). Purchasing needs therefore to build a solid internal network made of formal or unformal links tied among the community of colleagues working close from customers, in other terms business and marketing functions. The aim of this network is twofold: 1/ purchasing gets aware of customer needs and potential innovations that can be sourced outside and 2/ this network is also capable to listen to the result of the exploration phase when purchasing comes back with an innovation "*We have about 20 people from various department working full time on innovation exploration, making an internal community, but we have also contributors working part-time on the topic*".

The second source of awareness comes from the physical proximity with supply network (the suppliers and any stakeholder having innovative activities). Quality of the ties between purchasing and the "geography" of the supply network influence purchasing's awareness of new opportunities. Purchasing does efforts to stay close from sources of innovations, because the distance to innovative suppliers seems to be a key parameter. For example, SE Corp purchasing is involved in various innovation clusters, because "*clusters provide new*

opportunities of sourcing innovation. It makes us aware of an unknown firm's strength, product or service". These clusters attract specialized suppliers, start-ups and new entrants. Clusters consequently become a source of knowledge and a facilitator of complementary alliances. SE Corp is also more likely turned towards trade associations or start-up incubators. "*These sources all serve as platforms to share data, to enlarge the scope of supply network. We find opportunities for exploring new technologies, to communicate our needs, and to interact with our pairs"*.

b) SE Corp Purchasing motivations to explore innovations: At SE Corp, culture and strategic priorities related to innovation are shaped by those who govern and this is spread through firm's values and missions to all employees. SE Corp's culture is oriented to long-term views where innovation is a priority. SE Corp's CEO, who is in this stable position for more than a decade, leads the vision about innovation: "*innovation comes first from the CEO. Our CEO has an excellent strategic vision and has inspired many transformations in the company since he arrived. He can anticipate the market and push innovation forward, guiding us to the right direction*" (SE Corp Purchasing-Innovation Director). Focus towards innovation comes therefore from the top management and it impacts employees' motivations to align functional strategies to corporate strategy: "*corporate strategy is clearly oriented towards innovation, which facilitates alignment with functional and operational tasks and make people move forward. It is coherent*". At SE Corp, another incentive for purchasing is that buyers are more and more solicited by other departments to support them in tricky relationships with innovative suppliers. "*We realized that innovations which are dealt with suppliers directly by R&D would come back, in fine, under purchasing management. Therefore, that's logical to involve purchasing early in these activities, to avoid discovering problems later in a program"*. Purchasing is more and more expected to be involved early in innovation programs (which are different from development programs), to know what's happen and to be part of decisions. *"Our motivation comes from the incentive that purchasing must be involved in everything about supply relationship management. So, let's apply our best practices with innovation sourcing as well"*. SE Corp has implemented a few metrics to measure innovation sourcing performance "*we count the number of suppliers' innovations that have been adopted"*. This provides a strong incentive to find innovation opportunities. However, they still struggle at measuring the impact of suppliers' innovations, although they feel the impact is in a continuous progress "*measuring the adoption is a first step. It is the most important motivation factor, because we measure purchasing work*". SE Corp has two other metrics measuring collaboration level with strategic suppliers, where contribution to innovation is also assessed. Motivations are also from extrinsic origins. Until recent years, SE Corp as seen as a technological company, "*targeting product performance, reliability and safety*". A recent shift of market expectations towards service-integrated products, which was not the core technology in these firms, imposed a new product positioning and "re-birth" of the company. Applied to the context we are studying, we build on Chen et al (2015) and we assume that "industry crisis" can be this huge change in the market associated with sales warning, pushing both companies to "get together" with suppliers in order to innovate and "renew technologies". Motivations are expected to be change as well when the market evolves and calls for new innovative products. Drastic changes in the market is an extrinsic motivation to engage for a change, and to increase risks taken "*It is sometimes better to arrive first on the market with an un-perfect product, rather than being second with a perfect product: the first launch will shape the market and take position. Perfect means "the best" for us, this was the only market approach we had. Launching an innovative but un-perfect product is really a huge cultural change, while we use to launch only mature products with fully certified performances. We start to understand that segmenting the product portfolio is necessary to adapt the performance to the market"*. SE Corp has understood the opportunity to get complementary assets from suppliers. "*We have a strong conviction that suppliers can contribute to our firm's innovation capabilities, but that this resource is under-exploited. Ten*

years ago, suppliers were expected only to execute innovations designed inside, or to contribute to product/process performance improvement ». Finally, motivations raise up at the individual level (intrinsic motivations): At SE Corp, main intrinsic motivation comes from the willingness to influence all strategic decision related to outside supplies (incl. innovation). "*We [purchasing] want to be associated to innovation and we accept to have limited control on decisions, rather than being involved late or at the end of the product development, i.e. when the product is mature. The problem of being involved late is that we discover the context of the innovation too late and therefore our contribution is very limited. We want to be involved as early as possible and, at least, to know what's happen. We want to influence decisions, raise alerts or identify risks in the relationship with an external partner"*.

c) SE Corp purchasing capabilities: SE Corp emphasized the opposition of traditional strategic resources (core capabilities) and new core capabilities: the first relates to the ability to "*develop performing, reliable and robust products, designed inside, because we have a heritage of safety-related products. To do that, we need experts in various engineering domains, and a good capacity to develop what the market demands, where purchasing is expected to source what is designed inside"*. Purchasing is traditionally involved during new product developments, when purchasers look at their network to find suppliers capable to execute an innovation designed inside. SE Corp reports that "*Traditional capabilities have a reverse effect that inhibits innovation*". Therefore, they have developed new core capabilities to explore innovation designed outside the firm, among which a specific function to explore innovation ("Purchasing Innovation"), capable to focus on innovation exploration full time. At SE Corp, this differentiated structure exists, but not at DD Corp where purchasing function deals both with daily tasks and explorative activities. This new function "Purchasing Innovation" is independent from purchasing category management and purchasing product development but still belong to purchasing organisation. A few purchasers belong to this differentiated entity. This organisational design imposes two distinct and autonomous units, one dealing with innovation exploration, another with innovation development (new products), category and project management. SE Corp considers that this structural differentiation is the best way to achieve concrete results in innovation: *"... the best is to have fully dedicated teams, because we've well understood that we cannot explore innovation only working 5% of the time on this topic. The reason is that if you're too much involved in daily operational tasks and program development, the priority will be operational or program emergencies. There is a critical size to reach, let's say the minimum is 50% of your time involved in innovation, the better is full time of course*". This explorative unit is smaller, more decentralized, and more flexible than the core purchasing team. SE Corp emphasize the importance of strong linkages between explorative unit and the rest of the firm, this is ensured by a set of routines and directives, also enhanced by resource sharing, coordination and control.

The way purchasing has shaped its supply network is an important driver of exploration at SE Corp. Purchasing exploration capabilities are enhanced if the firm has of a good access to abundant and various innovation providers. At SE Corp, "*the external environment supporting innovation is made of four different layers: 1/ Existing strategic suppliers with whom they already have a partnership 2/ Known suppliers but not previously identified as innovators 3/ Large ecosystems, clusters of innovations, some geographical regions where innovators are more concentrated (two zones in the US) and 4/ Universities and academics.*" Purchasing is therefore connected with start-ups incubators and competitive poles, such as "The French Tech" in France. SE Corp considers also that purchasing must be able to investigate distant but localized innovative ecosystems (ie same as French tech but in other countries). "*This might depend on state policies, but innovative clusters are present in many countries*". However, SE Corp purchasing has very few contacts with academics and universities.

Last, the individual level can provide exploration capabilities as well. Capabilities are enhanced by individual culture. Innovation purchasers are curious, listen to multiple sources of potential

innovations. "*This is a non-ending process of surveying the market outside the firm, to take notes of each and every little sign of opportunity, and to think permanently of the potential use and benefit for SE Corp*". SE Corp pointed out the importance human resources hiring from other industrial sectors, to merge external knowledge with existing "traditional" knowledge. Hiring, training and exploiting talented people from other industries is considered as a new core capability, because it brings a real competitive advantage. People have a different mindset and another business perspective compared to the traditional SE Corp view. "*We hire people from other industries, such as IT, to get fresh blood in our resources and to boost our ability to explore markets*". To complete this extra-ordinary view, SE Corp invests heavily in people's training to make them merge their view with firm's own culture.

6 – CROSS-CASE ANALYSIS

In this section, we present the cross-case analysis: we compare the two cases and their contexts. We have summarized all cross-case findings within the Table 5, but we took the most relevant findings respectively from Awareness, Motivation and Capabilities.

a) Cross-case findings about Awareness: *Purchasing awareness of an innovation might come from various origins, but is facilitated by purchasing integration into Business Development knowledge, in addition to the integration into R&D.*

In the context of fast-paced environment and ever-more demanding markets, companies must stay very close from their customers and adapt their products to potential future customer needs. In both companies we studied, suppliers' resources are increasingly considered as potentially provider of innovation, but the two firms have different approaches to bridge suppliers' capabilities and customer future needs. At DD corp, purchasing get incentives to find resources in order to develop an innovation designed inside, whereas at SE Corp, purchasing is works closely with business development and marketing to stay aware of future business needs. For them, bridging marketing function with purchasing enhance functional alignment to better share informations and decisions. We consider that SE Corp is the more mature company we studied in terms of purchasing contribution to innovation management: purchasing collects data from customers through business development department. We think this is a fundamental approach to increase purchasing awareness of new needs and to better contribute to innovation exploration process. Reviewing technological road-map with R&D is not sufficient to acquire the necessary understanding of which innovation will be likely "marketable" after it is absorbed by the firm. This idea is supported as well by the notion of marketing and purchasing co-management synergies (Lindgreen et al., 2016). This co-management calls for continuous alignment of customer needs with supply network capabilities, sequentially or simultaneously (Wagner and Eggert, 2016), and provides positive influence on product development speed (Gonzales-Zapatero et al., 2017). This calls for inter-dependant tasks, specific processes, what scholar name "functional integration", referring to "intra-firm collaboration and information sharing activities" (Swink and Schoenherr, 2015). Gonzales-Zapatero et al (2017) describe the functional integration as a bi-dimensional process, which needs shared and understood information as well as aligned decisions. In our study, we noted that purchasing function in charge of innovation exploration and business development functions were highly inter-connected, exchanging information about customer needs and suppliers capabilities. This provides an efficient stream of communication which improves the efficiency of the innovation exploration process within the supply market. These findings suit with those raised by Information Processing Theory, where scholars suggest that companies in a context of uncertainty must organize themselves into specialized but inter-dependant sub-units, and build information processes between sub-units to better deal with the uncertainty (Tushman and Nadler, 1978). These findings are also compatible with those of Gonzales-Zapatero et al (2017), providing insights about the benefits of purchasing-marketing integration on product development, as well as creativity or suppliers' innovation capabilities (Schoenherr et al, 2012).

b) Cross-case findings about Motivations: *Incentives to encourage purchasing to innovation exploration come from multiple factors: intrinsic (human factors like curiosity and experience), firm factors (values, culture, managerial targets) but in our case both firms are mainly influenced by extrinsic motivations (market evolution, incentives from customers).*

Managers of large corporations often complain that it is hard to induce their employees to be more innovative (Manso, 2010). In both cases we studied, we see that SE Corp has a better success to involve purchasing in innovation exploration because purchasers feel involved in this process, they're intrinsically motivated to leave their comfort zone, take risks and explore. HR management and hiring process is therefore important. But what characterize purchasing motivation in both cases is a radical technological shift in the market which forces firms to change and to renew technology. This market and technological uncertainty influence purchasing contribution to innovation, provided that these changes are important and put firm's market at risk. At DD Corp, firm's traditional market is at risk because now customers expect services in addition to the product (connectivity, cloud services, data management, customizability), whereas at SE Corp, solving "customers pains" represent the main motivation. These technological shifts might be considered as "crisis", as Chen et al (2015) explains that "when industries are facing crisis, there is an incentive for firms to get together to set standards, renew technologies, and develop more appropriate business models » (Chen et al 2015).

c) Cross-case findings about Capabilities (1/2): *In both firms, a big difference resides in the purchasing organization structure, and the way purchasing deals with tasks related to exploration: at SE Corp, there is a specific unit dealing with exploration full time, whereas this specific unit does not exist at DD Corp.* By comparing the two cases studies, we discovered that purchasing contribution to innovation exploration reach a better success in the firm which set up a dual functional structure within purchasing function. In this company, one functional structure oversees "traditional" exploration, i.e. supports R&D in new products developments and sources "designed inside innovation"; the other functional structure is clearly distinct because it is fully focused on innovation exploration. This notion of organisational structure differentiation is already found in the literature, for instance when Boumgarden et al. (2012) argue that organisations promoting exploration are different from traditional organisations. This suggestion has never been confirmed in purchasing field, and our case study put more light in how purchasing function might better contribute to innovation exploration with a distinct and autonomous unit focused on exploration. We saw that this structure needs complementarities and has strong links with the rest of the firm to reach a balance in execution, for instance it needs a very strong internal network. Linkages between explorative structure and the rest of the firm are ensured by a set of routines and directives, also enhanced by resource sharing, coordination and control (Boumgarden et al, 2012). Looking at the findings of our study, we suggest that the organisational structural differentiation is better to promote purchasing contribution to innovation exploration. Purchasers, if they deal with daily tasks as well as explorative tasks in the same time, are not efficient enough. At SE Corp, the best level of maturity we investigated, we can see that purchasing is at the heart of an ecosystem to succeed in explorative tasks. This confirms recent views from the literature (Gualandris and Legenvre, 2017). Also, this matches with the need of a "smaller, more decentralized, and more flexible unit", if companies want to better explore (Raish et al 2009).

d) Cross-case findings about Capabilities (2/2)*: Purchasers' individual particularities such as experience and practice are the key factors influencing innovation exploration capabilities. This refers to people's culture, background, experience, creativity, agility to explore innovation.* This topic emerges during several discussions with both firms. This dimension is related to knowledge and skills embodied in people. Our findings report a clear distinction between traditional individual capabilities, and specific individual capabilities needed to innovation exploration. At SE Corp, traditional capabilities are embodied in people's head for a long time and reflect the accumulation, codification and structuration of knowledge. The

traditional approach is focused on technology developed inside the company, when purchasing raises expectations to suppliers and expects an answer. "*People have a monocultural approach to product innovation: always the same methods ("designed inside"), same focus on "product performance and safety" and same typology of response to the market"*. One challenge is to change this culture, and to develop new individual behaviours, without jeopardizing the brand image if it fails. *"It depends on people's culture, their exposure to outside the firm, and their background, and on their position inside the firm. The better push comes from people that are not coming from R&D or technical functions, because they're more used to exploration techniques."* Better opportunities to source innovations are given to those who can evolve from the historical behaviour "make or buy, but design inside": "*we're tempted to make everything ourselves, and to buy only if we have no other choices. You can imagine that asking our suppliers to support our manufacturing is quite common, but asking them to support R&D as well as innovation is quite disruptive for our R&D*". another difference is about the sourcing practice: purchasing has to look for suppliers based on functional specifications, not technical where the needs are precisely explained. Also, purchasing need to show the ability to convince others: "*our challenge is to convince our internal partners that our suppliers are not only executants but can also innovate*".

7- CONCLUSION

We summarize here our conclusions and their implications. We give future research directions as well as inputs for practitioners. This study has investigated three research questions: *What drives (motivates) purchasing to explore technological innovation? Which capabilities are required to make purchasing contributing to innovation exploration? How is purchasing made aware of innovation opportunities?* Following Chen and Miller (2015), we've used the lens of the AMC framework to investigate the content of the interviews, and we report on awareness, motivation and capabilities facilitating innovation exploration in the purchasing function. We have discovered many sub-drivers involved in the contribution to exploration, which are likely to be considered also but we selected four major factors among all others. Among them, we have highlighted that four factors are necessary to facilitate purchasing's contribution to innovation exploration: 1/ Purchasing awareness of an innovation is facilitated by purchasing integration into Business Development knowledge, in addition to the integration into R&D 2/ Purchasing's motivation to innovation exploration come mainly from extrinsic incentives (technological shift in the market) 3/ A specific purchasing unit dedicated to exploration tasks full time is a core capability 4/ Skilled resources, such as purchasers' culture, experience and creativity are key factors influencing innovation exploration capabilities. We suggest that these four factors are valuable for research purposes, because they do not appear in any literature on the field and might open future investigation about purchasing involvement in innovation eploration. Also, this study may help practitioners to assess purchasing involvement into innovation exploration phases, and help managers intending to shape, adapt or redesign their purchasing organizations to better explore innovations. However, we know that AMC framework suffers from lack of credibility, reliability and validation in the literature (Schweig, 2015). It is difficult to limit the understanding of purchasing contribution to only three factors (A, M, C), and even more difficult to attempt generalizing, but we think this model can be more used in purchasing field. We hope this paper will open future roads of research and attempts to empirically validate the AMC framework in purchasing.

	Purchasing Awareness	Purchasing Motivation	Purchasing Capabilities
Organization	Purchasing organizational structure and systems	Firm governance, culture, incentives	Strategic resources and core capabilities
Industry	Physical proximity with supply network	Market technological shifts	Resource-rich environment
Culture	Upbringing and socialization	Values and mores	Experience and practice

Table 1 – Purchasing AMC model adapted from Chen et al (2015)

Themes	Sub-themes	Source
Purchasing awareness	Action visibility (firm size)	Chen and Miller, 1994
	Visibility on the supply network	Ragatz et al, 2002
	Purchasing internal integration (interdisciplinarity)	Jansen et al, 2009
	Participation to innovation-oriented industrial clusters	Alfonso-Gil and Vazquez, 2010
	Dissemination of the information (accessibility)	Quintens et al, 2006
	Organizational structures and systems	Chen et al, 2015, Boumgarden et al, 2012
	Physical proximity	Chen et al, 2015
	Supplier integration	Narasimhan, 2013, Ragatz et al, 2002
Purchasing motivations	Competitive advantage and cost reduction gains from the innovat	Choi and Krause, 2006
	Getting or sharing the rights to use the innovation	Aghion and Tirole, 1994
	Territorial interests in different markets	Gimeno, 1999
	Innovation performance monitoring (formal v/s flexible)	Zimmermann et al, 2015
	Contracting long-term relationship with supplier	Clauss and Spieth, 2016
	Firm's governance, culture, values	Narasimhan, 2013; Pihlajamaa, 2017
	Explicit incentives (bonuses, rewards…)	Pihlajamaa, 2017; Sergeeva, 2015; Jansen et a
	Organizational support and involvement of innovation champions	Pihlajamaa, 2017
	Increase customer attractiveness	Schiele, 2010
Purchasing capabilities	Organizational structure and design (structural differentiation)	Birkinshaw et al, 2016
	Budget and policies for innovation search	Pihlajamaa et al, 2017
	Setting exploration tasks as routines	Lazear 2000; Shearer 2004
	Managerial systems	Leonard-Barton, 1992
	Information processing	Smith et al, 1991
	Creative mindset; curiosity-driven behaviour	Bessant et al., 2005; Amabile, 1996
	assimilation and dissemination of information on suppliers and markets, communication tools	Quintens et al, 2006
	Lnowledge and skills, abilities for the job in question	Campion et al, 2011
	relationship-building capabilities	Quintens et al, 2006
	A resource-rich supply environment	Chen and Miller, 2015

Table 2. Summary of themes and sub-themes found in the literature

Firm's name	Firm's core business	Date of Creation	Country of origin	Employees	Total nb of patent (as of 2016)	Innovations developped in 2016	Innovation in which purchasing contributed (2016)
SE Corp	Develops, manufactures and markets home/building automation systems, electric power distribution systems and industrial safety systems.	1836	France	150 000 (among which 1 800 employees in purchasing dept = 1,2%)	20 000	115	40 (35%)
DD Corp	Develops, manufactures and markets home/building automation systems, communication systems and energy management solutions.	1998	France	800 (among which 15 employees in purchasing dept = 1,8%)	350	25	1 (4%)

Table 3 – Case selection: descriptive data. Source: Authors

	Purchasing (senior level)		Purchasing (Operations)		Innovation Purchasing		R&D or R&I		Business devpt		TOTAL	
	SE Corp	DD Corp	SE Corp	DD Corp	SE Corp	DD Corp	SE Corp	DD Corp	SE Corp	DD Corp	SE Corp	DD Corp
Interviews (recorded)	2 (2)	2 (1)	6 (2)	3 (1)	6 (6)	0	3 (1)	4 (2)	1 (1)	1 (1)	18	10
Interview dates	08/12/2017 23/02/2018	22/09/2017	15/12/2017 18/12/2017 18/12/2017 26/01/2018 07/02/2018 08/02/2018	22/09/2017 19/12/2017 12/01/2018	06/10/2017 19/10/2017 09/11/2017 18/01/2018 19/01/2018 23/01/2018	N/A	22/01/2018 24/01/2018 25/01/2018	11/01/2018 31/01/2018	10/01/2018		GAND TOTAL = 28 interviews	
Average interview	0h45	1h36	1h48	1h24	1h54	N/A	1h31	1h14	1h39	1h20		

Table 4: Interviews conducted (Source: Authors)

		DD Corp	SE Corp
Purchasing Awareness	Main internal source of innnovation awareness	R&I first, then R&D	Business devpt + marketing first, then R&D
	Ratio of innovations designed in/outside	designed mainly inside, rarely outside (less than 10%)	designed outside 50%, 50% still inside
	Formulation of the needs	precise tech specifications, detailed datasheets	functional datasheets
	Supplier tech days	yes 1x year(tech day)	yes very often
	Frequency of use of open innovation techniques	never	continuously, specific tool designed for SE Corp.
	Process to share data between Puchasing and R&D	unformal, R&D benefits more from this communication	Specific communication tool implemented
	Internal start-up incubator	No	Yes (implemented internally)
	Participation to innovation-oriented clusters	No	Yes, frequent contacts with french / local clusters
	Distance with innovative suppliers	Large. Current base is made of trad strategic suppliers	Close. Exploration among new, distant innov. suppliers
Purchasing Motivation	Firm historical culture, values and positionning	Firm oriented towards technology development (market follower)	Innovation oriented (pro-activity, want to be the first)
	Governance and management incentives	Not clearly established, no incentive process.	Strong, and officialized within mission profile
	Impact of market shifts on motivation	Market impose changes, firm follwo the competition	Firm identifies "customer pains", i.e. implicit problems discovered among end user or customers, that can be solved through an innovation
	Metrics, KPIs to measure contribution to innovation	Vague description of a target within the mission profile.	Yes (clear count of innov sourced by purch and adopted)
	Corporate strategy refers to innovation sourcing	No	Yes
	Early purchasing involvement in innovation process	No	Yes, as soon as R&D feels the need to have a contract n the relationship with a new partner, to manage IP or secure costs.
	Intrinsic motivation to be part of innov process	Not really, because this is against firm's culture, internal reservations to listen to purchasing as an "innovator"	Yes, purchasers strongly want to be part of innovation sourcing, and take each opportunity to participate. Each innovation buyer feels embarked in the mission to be creative and innovate.
Purchasing Capabilities	Purchasing organization to develop/explore innov	Not differentiated: same purchasing unit to devlp/explore innovations. But hard to find time to explore innvovations.	Differentiated units : 1 unit to explore innovation, 1 unit to develop innovations. explorative unit is smaller, more decentralized, and more flexible than the core purchasing team,
	Perception of the supply network's capabilities	Current strategic suppliers are best placed to innovate	Classification of 4 different types of partners, defined as
	Individual capabilities	Good technological background, knowledge about firm process, curiosity, openness to new techs, learning capabilities	Curious, creative, rik-taking, trial/error mindset. SE Corp invest a lot in people hiring, to get "fresh blood" in the company and key competencies from different sectors.

Table 5: Cross-case findings (Source: Authors)

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The role of Total Cost of Ownership Tools in health care technology assessment – A case study in AAL

Dr Paul Davis (lead Author)
Dublin City University, Ireland

Eoghan McConalogue
Dublin City University, Ireland

Prof Regina Connolly
Dublin City University, Ireland

Abstract

Unless an appropriate route to market is found for healthcare technologies these benefits will not be realised. This paper highlights the role of Total Cost of Ownership when conducting a technology assessment by reviewing existent literature. In particular, this paper recommends that Total Cost of Ownership tools be developed in conjunction with industry collaboration and that these tools be incorporated as a key award criterion during the assessment and procurement process.This paper examines a case of Ambient Assisted Living technologies. These offer a unique opportunity to improve the quality of life of persons with mild cognitive impairments while also reducing economic pressures currently experienced by European health systems.

Keywords: technology, ambient assisted living, total cost of ownership, health systems, procurement

Introduction

World age profiles are changing. It is estimated that there will be two elderly people to every young person in the European Union by 2060, with 10% of the population estimated to be over the age of 80 by 2060 (Eurostat, 2011). In some cases, the change is more immediate. By 2010, 23% of the population of Japan was 60 years of age or older and that figure it is predicted to reach 39% within the next 40 years (SBJ, 2011). While in 2011 there were 535,393 people over the age of 65 in Ireland, a 14% increase from 2005. (CSO, 2011).

In tandem with a change in world age profiles has been the development of ambient assisted technologies (AAL), (Novitzky et al. 2014; Jacquemard et al. 2014). AAL technologies attempt to utilise sensory and cloud technologies as an eHealth solution. It is envisioned that these solutions will provide assistance and support to persons suffering various diseases such as cardio vascular disease (CVD) and mild cognitive impairment (MCI). Two horizon 2020 projects are currently tasked with the development of AAL technologies with the aim being to allow users suffering from a disease to aspire to an improved quality of life (QoL). Those suffering might enjoy the comforts of their own home. In addition, the application of AAL technologies can reduce the economic burden that currently rests on stressed health care systems, caregivers and patients, (Novitzky et al. 2014).

The promise of economic advantage and relief of health systems cannot occur unless appropriate market assessment tools for of AAL technologies are developed. The procurement and assessment of AAL technologies is a complex multi-layered process, particularly in the context of fragmented European health systems. A review of the healthcare delivery systems of partner countries within said projects elucidates the various and fragmented systems across Europe. Individual partner countries show varied combinations of public and private sector health care delivery systems (WHO, 2016). This analysis along with the experience of the two Horizon 2020 projects to date highlights the necessity to develop bespoke tools for assessment.

The two Horizon 2020 projects related to this paper present a timely opportunity. Both projects require the bespoke development of total cost of ownership tools. At project maturity both solutions will have trialled suitable total cost of owner ship tools and commercialisation routes. This knowledge, in conjunction with a review of various European health systems it has made it clear that developing a bespoke total cost of ownership tool for European-wide AAL technological solutions is imperative to their successful diffusion through health systems. This paper presents an initial review of the placing of TCO in the Health Technology Assessment Process. Primary data was gathered from the participating partners in the H2020 projects and a model for TCO is presented in the results. An Initial discussion is presented highlighting some of the issues associated with the models and in particular in costing activities that in the main are at a pre-commercial stage.

Literature Review

The World Health Organisation states that health technology assessment involves a systematic approach to the evaluation of properties, effects and impacts of a technology. It is a multidisciplinary task that incorporates social, economic, organisational and ethical considerations with an objective to inform policy decision making, (WHO, 2017)

An important precursor to the costing of medical technologies within a procedure is the acknowledgement that the procedure itself, including the medical technology, is of value to the health care system. Procurement authorities globally are increasingly using Health Technology Assessments when evaluating and sourcing medical technologies (IMSTA, 2014).

A Health Technology Assessment (HTA) is a systematic evaluation and multidisciplinary process used to evaluate the social, economic, organisational and ethical issues of a health intervention or health

technology. The purpose of an HTA is to provide independent evidence to justify the purchase of best-in-class medical technologies when finite budgets need to be balanced. HTA information should always be generated with reference to unbiased experts involved in clinical practice (IMSTA 2014).

Table 1: Benefits of Health Technology Assessments (HTAs)6

1	Provides appropriate health care decision making platform
2	Proven effectiveness, safe & cost effective
3	Exposes the decision making process to scrutiny
4	May be required for reimbursement
5	Ensures rational use of resources
6	Establish systematic & predicable process for introduction of new innovative treatments
7	Can assist in removing obsolete technologies
8	Provides Patients with quick access to new treatments
9	Increases coordination, cooperation & transparency
10	Provides for suitable KPIs as a method to assess performance objectively

The process of undertaking medical technology HTAs varies between and within countries. There are numerous HTA units and initiatives across member states in Europe (WHO, 2015). Currently however, the majority of these units are assessment units for pharmaceuticals. The role HTAs play in pharmaceuticals is very different from that played in medical technologies. Typically, assessments on innovative drugs inform decision makers about pricing and reimbursement, the same is not true for medical technologies where a necessary strategic link between assessment and decision can be missing in many EU countries (MedTech Europe, 2017). Focusing on pharmaceuticals alone distorts medical decision making with regard to resource investments and patient care.

The dichotomy of European health systems, between public and private systems of delivery, elevates the role and influence of the assessment process relating to eHealth services. As assessors must evaluate the costs associated with the procurement of eHealth solutions during the technology assessment process, a clear understanding must be obtained of where costs gather along a product lifecycle; on the public or private side for example.

A big picture understanding of product or service life cycles is therefore required to complete a technology assessment. Models that assess the life cycle of a technology must reflect the particular industry and body of stakeholders for which it is intended.

The procurement process is not always fully documented, particularly in the public sector. In an effort to harmonise methodologies Caldwell et al (2007) has outlined a procurement process based on Van Weeles (2004) model. The result is a six stage process; specification, supplier selection, contracting, ordering, expediting and follow-up / evaluation.

The assessment and procurement of AAL technologies is particularly complex. Consideration must be given to existing medical support infrastructure, the supply of utility services such as electricity, cloud services, staff training and implementation. In some institutions the assessment and procurement of AAL technologies can be perceived as a strategic activity, necessitating a medium to long-term scope. Aiding this process the Total Cost of Ownership tool (TCO) (Hurkens and Wynstra, 2006) is used to understand indirect costs. This allows organisations to assess the lowest possible cost to be incurred when in negotiation with suppliers (Van Weele, 2004).

Ellram and Siferd (1998) have identified three segments to successful TCO analysis; operational, tactical and strategic. Through the TCO analysis organisations can uncover opportunities to either avoid or reduce cost. Due to the fragmented nature of European health systems this can prove to be a difficult task. Not only is there a lack of a common framework for deployment but cost structures vary from state to state.

TCO analysis highlights the many layers involved in the assessment of a technology. For example, it is often the case that the assessment and acquisition of an AAL technology includes the considered procurement of a product and service. As a result, performing TCO analysis during a technology assessment not only informs matters relating to direct and indirect cost (Leenders et al, 2006) but also elucidates a number of other influential factors:

- cost reduction opportunities
- supplier evaluation and selection criteria
- data for negotiations
- points to focus suppliers on cost reduction opportunities
- advantages of expensive, high quality items
- clarification and definition of supplier performance expectations
- a long term supply perspective
- forecasting for future performance.

A variety of TCO models have been proposed (Ferrin et al (2003)) and many studies (Zachariassen et al, 2011) have shown that TCO can effectively support sourcing decisions at different levels. However the tools themselves are not widely adopted (Hurkens et al , 2006) due to the complexity of data that has to be gathered and the complex activity based costing that has to be done. In general though there are a number of methods for estimating TCO. Organisations generally choose a TCO approach from one of two overriding methodologies; a standardised TCO tool approach or the development of a bespoke tool.

Hurkens et al (2006) highlight a number of methods to use when estimating costs. The first of these, the monetary based method, which allocates the costs of purchasing a service or product to the different true costs of components in the offering.

The second method is the cost-ratio or value based method, (Carr and Ittner, 1992; Ellram 1995). This method incorporates the monetary method with qualitative performance data. By evaluating non-monetary data, a suppler rating score can be amassed, resulting in a total cost factor, (Wynstra and Hurkens, 2006).

Benton and Shin (2007) offer a third model that introduces five performance factors; quality, delivery, technology, price and service. Suppliers are given a numeric rating, the highest being 1.0, indicating hidden cost of ownership.

Methodology

Over the course of the three years of both H2020 projects the assessment of the technologies and their impacts were approached through a variety of means. Initially a review of current models of HTA was undertaken. Secondly a review of the current practices in health systems (in particular the use of procurement regimes implemented in EU member states participating in the projects) was undertaken. Both of these pieces of work have been published previously as part of the deliverables for the H2020 projects.

A primary data tool was developed. This was designed to capture both supply and cost information from the parties participating. Initial data was to capture the approach to market and initial pricing models being looked at. A total of 26 partners received and fill in the initial data set.

Payers	After the end of the project, who do you think could pay for IN LIFE tools? (you can select more than one option)	☐National public authority ☐Regional public authority X Local public authority ☐Hospitals X Residential homes ☐Insurance companies X Elderly X Carers ☐NGOs ☐Advertisers. ☐Private companies. Specify the type: ☐Nobody ☐Others (specify):
	Which of these stakeholders will probably pay a higher price? Why?	
	After the end of the project, who do you think could pay for the IN LIFE platform? (you can select more than one option)	☐National public authority ☐Regional public authority X Local public authority ☐Hospitals ☐Residential homes ☐Insurance companies ☐Elderly ☐Carers ☐NGOs ☐Providers of services included in IN LIFE ☐Advertisers. Specify the type: ☐Private companies. Specify the type: ☐Nobody ☐Others (specify):
	Which of these stakeholders will probably pay a higher price? Why?	

Pricing model	Which pricing model do you consider more suitable for IN LIFE tools? (you can select more than one option)	☐ Fee per transaction/purchase x Subscription fee ☐ Monthly x Yearly ☐ Other: ☐ Pay-per-use X Licensing ☐ Freemium (the tool is offered for free but there are fees for extra components) ☐ Advertising. (The tool is provided for free or a cheaper price in exchange of ads)

		☐ Data model. (The tool is provided for free or a cheaper price in exchange of collecting some data from the user) ☐ Other(s) (specify):
	Why?	
	Which pricing model do you consider more suitable for the IN LIFE platform? (you can select more than one option)	☐ Subscription fee ☐ Monthly ☐ Yearly ☐ Other: ☐ Pay-per-use X Licensing ☐Freemium (access is offered for free but there are fees for extra components) ☐ Advertising (Access is provided for free or cheaper in exchange of ads) ☐ Data model. (Access is provided for free or cheaper in exchange of collecting some data from users) ☐ Other(s) (specify):
	Why?	Licencing might allow a licence holder for a certain area to personalise the services offered through the platform and to add others.

A second set of data sheets was then sent to all partners this time capturing the cost information and further information about the approach to commercialisation. This involved all 26 partners over the two projects. Further information was also sought through a series of workshops where a total of 17 partners were present. The second set of data was based around a similar toolset to the above but now included information on

- Production and delivery costs (one-off).
- Usage cost..
- Maintenance costs.
- Monitoring of a health professional.
- Other costs.
- Cost per user:
- Payers:.
- Pricing mechanism:
- Current/expected price:

Results

Because of the wide nature of products being developed for AAL as part of the H2020 projects and also because many were in a pre-commercial stage there was little hard data on costs. Instead categories were developed for the tools and a generic TCO toolset was piloted for the two H2020 projects.

A workbook was developed for each partner to fill in. The main headings used were

Direct Costs	
Hardware & Software	The capital expenditures and lease fees for servers, client computers, peripherals, network components, and software.
Management	The costs associated with network, system and storage management, including labor staffing, maintenance contracts, and professional services or outsourcing fees.
Support	The support staff labor hours and costs, training labor and fees, travel, support contracts and management overhead.
Implementation	Cost associated with the implementation of the application. These usually include development (customization and integration), testing, training, and consulting.
Communications fees	The inter-computer communication expenses for leased lines, remote access, and allocated WAN expenses.
Indirect Costs	
End user IS	The cost of formal end-user training, casual learning, informal support outside recognized IT support channels, self-development of applications, and local file maintenance.
Downtime	The lost productivity due to planned and unplanned network, system, and application unavailability.

These categories were further broken down into a more detailed model.

Direct Costs	Year 1	Year 2	Year 3	Year 4	Total (€)	% of Total Cost
Hardware						
Servers	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Client computers	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Peripherals	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Network components	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Maintenance fees	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Hardware Costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Software						
License	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Maintenance fees	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Software Costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Management						
Network	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Systems	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Storage	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Management Costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Support						
Support staff	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Training fees	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Procurement procedures	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Travel	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Support contracts	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Overhead labor	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Support Costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Implementation						
Development/customization/integration	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Training	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Consulting/system integration	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Implementation Costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Communication Fees						
Local Area Network	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Wide Area Network	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Remote Access	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Communication Fees	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Direct Costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!

Indirect Costs	Year 1	Year 2	Year 3	Year 4	Total (€)	% of Total Costs
End User IS						
Formal end-user training	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Informal end-user training	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Self development of applications	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Local file maintenance	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total End User IS costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Downtime						
Planned downtime	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Unplanned downtime	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
...	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Downtime costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Indirect Costs	€ -	€ -	€ -	€ -	€ -	#DIV/0!
Total Costs	€ -	€ -	€ -	€ -	€ -	

This model was tested across 19 of the 26 partners who had sufficient data to use it.

Discussion and conclusion

Although research exists on TCO models it should be noted that there is little analysis existing on its application in the context of AAL technologies to be diffused on a European-wide scale across varying health care systems. There is an opportunity for further research to develop this area particularly with regard to public and private sector collaborations. It is recommended that future TCO models be developed in conjunction with industry partners. It is also recommended that the TCO process be developed into a key award criterion when conducting AAL technology assessment and procurements, thus aiding long term strategic decision making.

In developing the models and the toolsets one of the key problems is the lack of information on behalf of suppliers , in the case of the H2020 projects this may have been University, Campus Companies or SME's. This information may seem basic but it hampered the development of the models further. One of the key deficits in the developing the models was also the lack of information on Quality of Life Indicators which would have given an economic benefit. Many organisations lack both basic accounting information but have little knowledge of complex calculations such as QaL which are being by procurement authorities in assessing Health Technologies.

There is limitations in the methodology employed, future studies should consider qualitative interviews with practitioners. This is only an initial working paper which set out to explore the usefulness of these tools in a unique environment.

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About the authors

Dr. Paul Davis is Head of the Management Group (School) in Faculty of Business in DCU. He is a past council member and past president for the Irish Institute of Purchasing and Materials Management. He has previously been seconded to the Health Service Executive ICT Strategy Unit, advising on procurement strategy and market engagement. Dr Davis was lead PI in DCU for the Winning in Tendering Project. The project has a budget of €3.7 million euro. He is currently PI for the following H2020 projects in DCU Business School: Pathway, Magic, Inlife. Author can be contacted at **paul.davis@dcu.ie**

Eoghan McConalogue is a PhD candidate at Dublin City University. His research has a focus on eHealth technologies, self-disclosure and trust. Author can be contacted at **eoghan.mcconalogue@dcu.ie**

Prof Regina Connolly has significant expertise in healthcare technology impact assessment as well as eHealth business model development and is a Lead Investigator in several international Ambient Healthcare Technology research projects that were awarded over €8.43 million in funding from the European Commission in 2014. She is also a lead investigator in a pre-commercial health technology procurement proposal that was awarded over €5.1 million in European funding in 2015. In 2016, the H2020 public health research project (MIDAS) which she co-leads with Ulster University was awarded €3.1 million in European funding. Author can be contacted at **regina.connolly@dcu.ie**

Theoretical background of Supply Chain and Finance integration: a focus group approach

Ronald de Boer[1], Rob Dekkers[2], Luca Mattia Gelsomino[1], Christiaan de Goeij[1], Michiel Steeman1, Qijun Zhou[2], Scott Sinclair[3] and Victoria Souter[3]

1 Windesheim University of Applied Sciences, The Netherlands

2 University of Glasgow, United Kingdom

3 Centre for Engineering Education and Development, United Kingdom

Summary
The use of financial constructs to support coordination across supply chains is generally underdeveloped. This lack of integration is particularly affecting small and medium enterprises, because their access to capital is seen as challenging. Supply chain finance (SCF) is an effective approach to improve financial collaboration, offering a wide variety of mutually beneficial schemes. This paper aims at analyse SCF and integration between supply chain and finance in light of relevant theories of the firm, conducting exploratory research based on a focus group study among Scottish companies representing different industries. The results are analysed against relevant theories to provide a better understanding of the underlying theoretical implications and determinants in financial supply chain management.

Keywords
Financial Supply Chain Management, Supply Chain Finance, transaction cost economics; Agency Theory; Network Theory; Collaborative Networks; Social Exchange Theory

Introduction

Finance has traditionally be represented solely as a department (or function) within organisations in logistics and supply chain management literature, as in Lambert and Cooper (2000). However, more recently authors argue that financial flows across organisations should receive the same amount of attention as goods and information (Martin, 2017). Even Mentzer et al. (2001), in their seminal contribution towards the definition of the concept of supply chain management, (SCM) expanded the conceptualisation of flows in supply chains by including finance; thus: products (or services), information and finance constitute the backbone of a supply chain. However, it is safe to say that these three types of flow have received different levels of attention from the academic community so far. Product flows are arguably the most consolidated stream of research in SCM, with several sub-streams focused on their management and optimisation (e.g. Zhang et al., 2014). Along the same lines, recent developments resulted in more complex information management systems intra- and inter-firms in the supply chain (e.g. Koh et al., 2011). For the third type of flow, as highlighted by several authors (Blackman et al., 2013; Pfohl and Gomm, 2009), finance has received considerable less attention compared to product or information flows. This gap is not only restricted to the management of financial flows, but extends to holistic management of the three flows in integrated supply chain

frameworks (Hofmann, 2005; Pfohl and Gomm, 2009; Wuttke et al., 2013b). However, since the late 2000s, the concept of Supply Chain Finance (SCF) has sprung in literature, strongly contributed to a burst of attention of both practitioner and academia towards the management of financial flows at the supply chain level.

Background

The literature on SCF can be divided into two strands. The first address the financial aspect of supply chains as a set of financial arrangements, usually driven by a large, credit-worthy buyer (More and Basu, 2013; Wuttke et al., 2013a) The second addresses it from a SCM standpoint, highlighting its impact on the financial performance of an entire supply chain, and enlarging its scope to typical collaborative solutions and fixed assets (Gomm, 2010; Hofmann, 2005; Pfohl and Gomm, 2009; Randall and Farris II, 2009). For the purpose of the current paper, SCF can be defined as the optimisation of the financial flows and allocation of financial resources in a supply chain with the aim to increase value, requiring the collaboration of at least two primary supply chain members. The financial flows and allocation of financial resources can be possibly facilitated by external service providers. Benefits of SCF are derived from an improved management of financial flows at the level of supply chains and of a more adequate allocation of financial resources to actors in these chains. Such better management is translated in reduced cost or need for financial resources: an example of this thinking is the 'SCF cube' (Gomm, 2010; Pfohl and Gomm, 2009), describing the positive impact of SCF in terms of reduction in volume, duration and cost of financing. Additional benefits are reduced risk of bankruptcy along the supply chain (Klapper, 2006) and easier access to liquidity for small-high risk suppliers (Berger et al., 2004; Klapper, 2006; Tanrisever et al., 2012). Moreover, SCF increases visibility for supply chain members and it enhances further information sharing, integration and collaboration (Hofmann and Belin, 2011; Lamoureux and Evans, 2011; Pfohl and Gomm, 2009). Thus, SCF as defined in this paper could be classified as belonging to the second stream.

Paper scope and outline

Despite the expanding literature base about SCF, contributions so far are relatively a-theoretical; the development of more solid theoretical bases has already been identified as one of the major gaps (Gelsomino et al., 2016). Thus, empirically-based literature correctly positions the topic of SCF within existing foci of SCM (e.g. supply chain collaboration), but seldom frames results in theoretical lenses, and, if so, limiting them to sporadic referral (Caniato et al., 2016; Wuttke et al., 2013b). Although this is understandable, considered the relatively novelty of the topic and its practical orientation, it is time to address this gap in literature. Therefore, the purpose of this article is to connect theories of the firm and theories for collaborative networks with the concept of integrated Supply Chain and Finance management, driven by an empirical study.

To do so, the paper provides a review of theoretical lenses and connects these to the results of a focus group conducted in Scotland in 2017. The literature review follows the guidelines from Green et al. (2006). After the narrative review of theories, the third section sets out the research methodology for the focus group. Its results are presented in Section 4, followed by a discussion of the findings in the fifth section. A final section concludes with practical implications and an extensive research agenda.

Theoretical perspectives pertaining to Supply Chain Finance

These implications and this research agenda are derived from theoretical lenses. Such theoretical lenses should cover at least (i) the interaction between two actors in the supply chain following our definition of SCF and (ii) be suitable to cover financial aspects. We have limited these lenses to five different theories that present potential explanatory power for SCF: transaction cost economics (TCE), agency theory (AT), Network Theory (NT), Collaborative

Networks (CNs), and Social Exchange Theory (SET). Table 1 summarises the key theoretical concepts streaming form literature on those theories.

Transaction Cost Economics

As the first of the five theories, TCE (Williamson, 1979) is considered a foundational theory that provides understanding of firms' motives and behaviour concerning entering and governing inter-organisational arrangements. As a result, it has been very influential in supply chain management literature addressing themes, such as strategic sourcing and outsourcing decisions (Williamson, 2008), market entry strategy (e.g. Anderson and Gatignon, 1986), buyer-supplier relationships in general (e.g. Heide and Stump, 1995) and more recently supply chain risk management (Blome and Schoenherr, 2011; Ellram et al., 2008). TCE assumes that organisations in their attempt to improve efficiency not only concentrate on production costs, but also include transaction cost in their evaluation representing 'the cost of running a relationship' (Carr and Pearson, 1999). These costs to 'contact, contract, and control' (Halldorsson et al., 2007) include both *ex ante* transaction cost (searching, evaluation and negotiation) cost as well as *ex post* (measuring, monitoring and enforcing) control cost Within the framework of transaction cost economics, decisions are not only influenced by Coase's (1937) transaction cost, but also, among other things, determined by frequency of transactions, uncertainty about future transactions and asset specificity. Thus, TCE attempts to provide a behavioural perspective on Coase's concept of transaction cost.

Four core assumptions form the basis of the TCE theory, these are:

- *Bounded rationality*. Because managers are limited in their available time, the (cognitive) perception of situations, access to relevant information and capability to process it, they cannot accurately evaluate all feasible alternatives. Consequently, their decisions will not be perfectly rational.
- *Asset specificity*. Transaction specific investments have limited value in alternative applications, which may result in *small numbers bargaining* (decrease in the number of alternative suppliers or customers) or even to 'bilateral monopoly', which occurs if both the supplier and the buyer are locked into the transaction.
- *Potential for opportunism*. Asset specificity often causes the party that has not invested in relevant resources to have leverage in the relationship.
- *Alternative modes of governance*. In order to mitigate the risk of opportunism, parties strive to implement the most suitable governance structures. These arrangements may vary from occasional highly standardised purchases, which require a minimum amount of governance, to long-term contracts with penalty or shared revenue clauses, equity investments or even vertical integration. According to TCE, trust between the parties is not equal to personal trust between individuals, but purely based on 'calculated risk' (Williamson, 1979).

Mentions of TCE in relation to Financial SCM (Hofmann and Locker, 2009; van der Vliet et al., 2015) usually does not lead to theoretical frameworks. Similarly, Liebl et al. (2016) state that a theoretical framework is missing in their case study and suggest that the relationship between buyers, suppliers and banks could have been analysed through a TCE lens. The only study by Wuttke et al. (2013b) that bases its framework on TCE and argues that its key concepts help understanding the implementation and use of SCF. Furthermore, they state that friction within financial flows in supply chains exist and are an important component of transaction costs; thus, appropriate SCF strategies can lead to more efficient supply chains. That only four studies relate transaction cost economics in one way or another to SCF, either indicates that either transaction cost economics is inadequate or confirms the lack of theoretical conceptualisation for SCF.

Agency Theory

This raises the question whether the same is the case for the second theoretical conception: agency theory. In a principal-agent relationship, the agent works for the principal and therefore

both parties are engaged in a cooperation. However, the principal and the agent have different attitudes towards risk and different goals (Eisenhardt, 1989; Jensen and Meckling, 1976). The so-called agency problem arises when there are competing goals and when there is information asymmetry (Whipple and Roh, 2010). Goal conflicts and information asymmetry stimulate opportunistic behaviour and can lead to moral hazard, a lack of effort by the agent and adverse selection, when the agent falsely describes its capabilities (Eisenhardt, 1989). Agency costs exist when there is a deviation from the principal's interest by the agent. The principal can try to reduce agency costs by incentivising and monitoring the agent's behaviour. The focus of the theory is on the determination of the most suitable contract: a behaviour-based contract or an outcome-based contract (Eisenhardt, 1989). AT is relevant for buyer-supplier relationships, since information asymmetry and goal conflicts are present in these relationships (Fayezi et al., 2012; Zsidisin and Ellram, 2003).

Among the studies that link AT with SCF, Wandfluh et al. (2015) link AT to buyer-supplier relationships in the financial supply chain. They take the principal-agent perspective to see how purchasing and finance departments (two principals) can improve cooperation with suppliers (agents) and how this influences the overall financial performance. Gomm (2010) mentions banks as principles and the companies that need the capital as agents. He mentions information asymmetry: banks are outside of the supply chain and therefore have less information than the companies in the supply chain. Pfohl and Gomm (2009) adopt the principal-agent theory to compare an internally financed supply chain with an externally financed supply chain, and mention monitoring and long-term commitment as methods to reduce agency costs. (Liebl et al., 2016) state that '*alternatively principal agent theory can be applied in order to investigate information flows as well as different intentions of the collaborating supply chain partners'*. These four examples show there are conceptualisations using AT for the financial supply chain; however, no decisive modelling has emerged neither has the potential of AT been fully exploited.

Network Theory

With agency theory having found a foothold into SCF, the question is whether network theory as third theoretical perspective offers an explanatory framework. NT defines a network as two or more of organizations ('nodes') that are connected via relationships ('links') that develop through interactions (Thorelli, 1986) (albeit that this writing on a strategic perspective). Such interactions comprise exchange processes, consisting of transactions, social exchange and information exchange in addition to adaption processes, where parties mutually influence and adapt to each other technically, logistically, and administratively (Johanson and Mattsson, 1987). This means supply chains are not only simple linear systems that exchange goods, information and money, but complex adaptive systems that continuously adopting (e.g. Choi et al., 2001; Surana et al., 2005). In terms of complex systems, interactions are seen as dynamic with regard to collaboration, inter-organisational integration and decentralisation of decision-making (Dekkers and Bennett, 2010). The existence of two different views on network theory – one as strategic, one as dynamic – implies that its application to SCF should consider which one was used.

Although from a strategic perspective network links may contain strong as well as weak ties, and both may contribute to supply chain performance, providing reliability and flexibility respectively (Ketchen and Hult, 2007), NT mainly focuses on developing long-term, trust-based relationships between supply chain members. Such positive, stable relationships contribute to joint value creation, simplify decision processes and ensure access to resources and activities. According to Thorelli (1986), power is 'the central concept in network analysis', because it offers firms a differential advantage to create or influence a network. Sources of power include size, market position, technology, expertise, trust and legitimacy. Organisations that are able to establish a more central position in the network or create stronger relationships with focal firms that are assumed to a competitive advantage related to better access to resources

and information, and more control over coordination (concept of centrality). However, this demands strong internal collaboration. Thus, effective managers are not only looking for direct savings, but also interested in building intra- and inter-organisational trustworthy long-term relationships, by sharing information and knowledge and investing in trust; thus, appropriate mechanisms for SCF should contribute to achieving these goals.

Although NT has been widely adopted in SCM literature, topics such as long-term relationship development, intra-firm coordination, information sharing and administrative adaption are implicitly considered multiple times for SCF (More and Basu, 2013; Randall and Farris II, 2009; Wandfluh et al., 2015; Wuttke et al., 2013b). However, in none an, explicit reference to NT is made. The only exception is Song et al. (2015), who base their hypothesis that information sharing can lead to improved availability of capital for SMEs on NT; however, they do not explicitly specify which network theory are using. Thus, it can be concluded that network theory has been implicitly adopted for SCF, but works do insufficiently build towards theory. This is surprising since Thorelli (1986), describes an example of adding financing facilities to existing products/services as a repositioning move to increase centrality in a network. Furthermore, Johanson and Mattsson (1988) state that financial adaption between members may reduce misfit in the relationship.

Collaborative Networks

Whether theory building has taken place from the fourth theoretical perspective – collaborative networks – is now evaluated. CN are defined as 'a distinct mode of organisation in which participant organisations work together in equity, commitment and trust exchanging information, sharing activities and resources and complimenting and enhancing one another's capacity for mutual benefit and a common purpose by sharing risks, responsibilities and rewards' (Bititci et al., 2004a). Common forms of CNs includes virtual enterprises, (dynamic) virtual organisations, extended enterprises, virtual laboratory, industry clusters, and so on (Bititci et al., 2004b; Camarinha-Matos et al., 2011). However, there is not much concordance on which entity might or not be classified as CNs, such as supply chains. For example, Bitici et al. (Bititci et al., 2004b) states that supply chains are a basic form of collaborative networks, whereas Camarinha-Matos and Afsarmanesh (2005) identifies as example of CNs 'advanced and highly integrated supply chain'. This means that conceptualisations for collaborative networks may apply to supply chains.

However, whatever perspective adopted, this strand of studies tends to focus on structure, behaviour and evolving dynamics of such entities, to understand the way in which they compete towards the achievement of pre-defined goals (Dekkers, 2009). In this sense, research on collaborative networks has clearly potential for interconnection with SCF, particularly the integration of product and information flows with financial flows in supply chains. In fact, SCF agreements often require the creation and consolidation of network relationships that go beyond the typical buyer-supplier dyad. For example, Martin and Hofmann (2016) show how reverse factoring (one of the most common SCF solutions) can be interpreted in terms of collaborative triads between buyer, supplier and financial service providers. At the same time, the authors show how the level of inter- and intra-firm collaboration plays a significant role in implementing SCF solutions, often beyond standard expectation of the traditional buyer-supplier network relationships as found in Caniato et al. (2016) and Wuttke et al. (2013b). Such evidence represents a significant overlap with CNs, as literature on the topic highlight how CNs might be organic in nature, with the potential to grow and to extend in an adaptable structure. Although evidence of CN as a theoretical background in SCF is weak, it would seem to be straightforward to theorise based on the explanatory potential of CN in relation to SCF and the integration of physical and financial flows; such interconnection may result in SCF being examined, for example, in terms of CNs' knowledge integration methods (Jayaram and Pathak,

2013), decisions models (Renna, 2013) and impact on adoption of new practices (Chong et al., 2013).

Social Exchange Theory

The final theoretical perspective – social exchange theory – assumes that interactions between organisations or groups and individuals in organisations are driven by the rewards and costs that these interactions are expected to generate, to some extent akin TCE. However, SET argues that these rewards and costs are not limited to purely economic factors, but include social aspects, such as autonomy, social approval, security and companionship. When taking decisions, companies evaluate the expected intermediate and long-term outcomes of different alternatives and choose the one that promises the best overall trade-off. The accumulation of such results determines the satisfaction with each relationship, or its 'social capital', which can vary over time. However, the standards that different interactors use to evaluate different cost (including time, effort and money) and rewards (such as status, companionship and monetary rewards) may vary across the temporal dimension and from person to person (West and Turner, 2013). This can create relative dependences, which may result in power inequalities. Due to these dynamics, relationships are not static, but develop over time. Thus, relationships can deteriorate by lack of commitment and trust as well as diverging priorities and visions (Storey et al., 2005). However, trust, open communication and informational transparency can lead to improved business performance, which in turn leads to increased trust (the 'loop model', Akkermans et al., 2004). Fynes et al. (2008) suggest that parties should strive for positive relationships as these warrant stability and beneficial outcomes, whereas negative relationships increases risk and may lead to termination. Despite being adopted in SCM literature (e.g. Griffith et al., 2006; Kwon and Suh, 2005), this lens seems not to have been used for SCF; .even though, trust is a recurring theme in SCF (e.g. Martin and Hofmann, 2015; Randall and Farris II, 2009; Wuttke et al., 2013b); because trust and commitment play a central role in social exchange theory, it seems logical to include this theory in our analysis for SCF.

Methodology

Because these five theories could provide a better understanding of motives and behaviour in financial aspects of supply chain management, albeit in quite different ways, we constructed our research design adopting a focus group methodology. Focus groups, sometimes referred to as focus group interviews, group depth interviews, or group discussions, can be traced back to the 1920s and have found broad application among practitioner researchers in for example marketing and health nutritionists (Rabiee, 2004). Nevertheless, the use of focus groups, originally designed as an academic research tool, is 'now well established as a mainstream method across the fields of social research, where they are widely used and are an extremely valuable research approach' (Ritchie and Lewis, 2014). Not only has this method been advocated for social research, already Flynn (1990) added it to the repertoire for operations management. The focus groups method aims primarily at understanding the meaning and interpretations of a select group of people regarding a specific issue or set of topics (Kitzinger, 2005; Liamputtong, 2011). Thanks to group dynamics, which are lacking in one-to-one interviews, this approach usually results in the generation of 'deeper and richer data' (Rabiee, 2004). As we want to explore and better understand the processes and intentions that drive decisions of supply chain partners regarding the management of financial flows, this interpretive method seems a good fit as interactions in the group serve the group members to better express and clarify their points of view (the 'group effect').

Study design

The focus group session was opened with a 25 minute presentation of the core concepts of financial supply chain management and SCF. This opening presentation served the purpose of aligning on terminology and provide with a basic understanding of SCF. This is especially

important: as literature in the introductory section of this paper highlights, there is general misalignment on what constitute an "SCF scheme", which leads to confusion on whether specific schemes such as Reverse Factoring or Dynamic Discounting are, in fact, subject of discussion or not. The initial presentation did not mention the five identified theories, which were by themselves not directly the subject of the focus group discussion.

Although authors differ on how many participants should partake in the focus group discussion, there seems to be consensus that the ideal group size is between four and ten persons (Liamputtong, 2011). However, smaller groups consisting of four to ten participants provide more room for each individual to contribute and interact optimally and thus explore relevant themes in more detail, hence generating more relevant data (Krueger and Casey, 2015). In line with (Kitzinger, 1994), the group was divided in three subgroups (of 5-5-6 people) each addressing a different theme. The themes of the subgroups were financial aspects, process aspects and relationship aspects. In each subgroup, a group discussion, led by a moderator and one observer (authors of this paper), lasted for 30 minutes. After each session, the participants were rotated between groups, to increase group dynamics and so minimizing the probability of dominance of certain group members. In total, three rounds of discussion were held, totalling 90 minutes. In order to stimulate exploration, check understanding and promote discussion even more, post-it sticky notes and flip charts were used.

Profile of Participants

Potential participants were invited to partake through the Centre for Engineering Education and Development of Scotland, a regional business network. In total, 16 participants, representing 8 different organisations of varying industries were present. The organizations represented were SMEs (2), mid-size (2) and large corporations (4). Thus, we applied convenience sampling based on experience and interest in the relevant subject area, which is common practice in focus groups (Liamputtong, 2011). The presence of different industries provided the right level of heterogeneity within the sample, avoiding polarisation of issues and collaboration practices towards a specific industry. Multiple industries and multiple roles within the supply chain strengthened the generalisability of results, providing a plurality of point of views within the discussion.

Data collection and analysis

The group discussions were recorded and these recordings were transcribed on a later date. Both the moderator and the observer took notes independently during the session, and special attention was paid to non-verbal and interactions between group members. Directly after the session, the post-its, flip charts and notes were collected and compared to increase reliability and internal consistence. The data was then grouped logically to identify main categories of key themes and concepts.

In the weeks following the session, the authors used the transcriptions and other data to code the findings using the categorization of the debriefing session. This coding aided in identifying matching key theoretical concepts. This coding was done by three researchers working independently and then the results were compared afterwards.

Results

In general terms, data collected from the focus group align well with the theories identified as most of the key theoretical concepts emerged during the discussions on the integration of supply chain and finance in the sub groups.

The TCE concept of bounded rationality manifested clearly in the different focus group sessions. Especially, SMEs seem to be disadvantaged as the knowledge regarding financial flows and SCF arrangements is much less matured as that of their larger counterparts in the

supply chain. In all groups, the expressed opinions quickly converge on this. Participants stated that (most) SMEs have trouble understanding financial solutions, which may lead to increased risk or excessive cautiousness on their side. One participant confessed that when a buyer offered him VMI he did not understand the scheme, nor its cash flow implications, enough and therefore made the decision on 'gut feeling'. This phenomenon leads to increased relation specific implementation cost (such as legal advice and learning cost), which may increase the 'lock in' effect and increases fear for opportunism. As one participant declared: '..this is the red light that flushes'.

AT presents, potentially, a significant explanatory power for supply chain and finance integration. As presented in the section above, it is a widely spread mean of interpretation for buyer-supplier relationships, and therefore it is suitable also for understanding issues in supply chain and finance integration. More specifically, one of the most relevant outcome of the focus group regards the competing goals, both inter- and intra-company. As one participant stated, 'the 'S' in SME stands for suspicious and sceptical', a clear reference to the conflict of goals and relative mistrust that characterise every principal-agent relationship. On the other side, several participants highlight how more transparency and clarity of communication improve the management of financial flows, for example facilitating the adoption of SCF by suppliers. Principal-agent relationships can be identified also within the same company, between different departments (in alignment with literature on SCF, e.g. Caniato et al. 2016)), for example when participants depicted the finance department as a principal, 'ruling' over purchasing (the agent) on terms and conditions of transactions. This same concept seems to be true for other departments, as one participant illustratively referred to the finance department as 'Sales Prevention'. Some buyers consider it as a sign of weakness when one of its supplier asks for early cash. This may lead to suppliers not letting buyers know their needs, which may lead to suboptimal decisions (agency cost). An interesting phenomenon that seems to be present is that, as financial flows typically move in opposite directions, there appears to be a reverse principle-agency situation in the buyer-supplier dyad, as there are conflicting goals (buyer wants to pay as late as possible, while the supplier wants the opposite), the agent (the buyer) has more information (if the invoice has been approved, if the plan is to pay within the agreed terms, etc.) and could (and frequently does) act against the principle's (supplier's) best interest by paying late. This, evidently, brings agency cost in the relationship as the supplier needs to hedge this risk with additional cash or insurance.

Overall, our findings seem to indicate that NT has much common ground with the underlying mechanisms of financial management in supply chains. Financial aspects are clearly considered as part of the original power concept in NT (Thorelli, 1986), According to NT, companies with a better financial position have more leverage to influence the network, this was confirmed by the focus group discussion ('the big party dictates'). These dominant parties could utilize their influence to optimize financial flows in the network and thus improve overall network performance. On the other hand, organizations with less power in the network, could benefit from being in an SCF scheme with important SC partner, as it may increase their centrality which facilitates access to resources such as (cheaper) capital with bank. Participants clearly indicate that they are interested in long-term cooperative relationships and that if there is enough commitment and trust present, parties are more eager to make investments in the relationship. This means that early payment may be accepted more rapidly (by buyer), or SCF agreements, like reverse factoring might be adopted easier. If, on the other hand, the relationship is weak, a request for speedier payment, may turn out in switching to another supplier.

Unlike TCE or AT, CNs presents a somehow more limited scope of application for the integration of supply chain and finance. Although collaboration has been a key topic throughout all of the three groups, limited evidence was gathered to connect SCF implementation or financial supply chain management to archetypes of CNs reported in literature. The most relevant result stemming from the focus group sessions pertains the stages of maturity of the

collaboration between buyer and supplier: long term, stable relationship facilitate collaboration and sharing of information, hinting towards the strengthening of links typical of a CNs, while less long-term and strategic relationship might result in lack of collaborative effort. As effectively put by a buyer when discussing collaborative management of financial flows: 'the supplier must be on the radar'. A second result of interest is related to the (de)centralised decision making process in large corporates. Evidence from the focus group shows that the level of centralisation plays a crucial role in mediating the ability of companies towards implementing financial supply chain management practices, even at the single company level (e.g. accepting/refusing cash discount proposals). We identify potential of interpreting this results exploiting the body of research on distributed manufacturing within CNs.

Lastly, we found that SET has strong links to the findings in the focus group conversations. Almost in every session, trust came up as a self-evident prerequisite for effective financial management in supply chains. Comments like 'trust comes first' and the barrier that a lack of trust create in exchanging crucial information speak for themselves. The discussions made clear that levels of social capital exist, not only between organizations, but also between different persons in those organizations ('people buy from people but still there is a relationship between organisations'). This may indicate that it may be sensible to let the person that has the best relationship with the supplier discuss the more sensitive topic of SCF. Additionally, different departments within organizations appear to have different paradigm on optimal interactions with supply partners: business relationship development vs. a purely transactional relationship ('a happy customer/supplier vs getting paid'), this difference is maintained as internal communication between departments is far from optimal and functional silos exist, which hampers the integration of financial and logistical flows. Finally, although large companies possess more relative power, the data from the focus group seems to indicate that SMEs have other strengths, such as higher commitment and flexibility which could be deployed to improve the quality and interdependency of the relationship.

Conclusions

In this paper we have tried to lay a stronger foundation for Supply Chain Finance by looking for alignment between SCF and theories of the firm. The view of Scottish firms shows that there are clear linkages between SCF and TCE, AT, NT and SET, and to a lesser extent between SCF and CN. There are some recent studies that already link SCF with TCE and with AT. We were able to provide further findings on these linkages. Our results show that also NT and SET provide opportunities for building the theoretical foundation for SCF. These findings are not only relevant to academia, but also to practitioners. In particular our results show implications for alignment between buyer and supplier and alignment between different company departments.

A limitation of the research is that there might be additional firm theories that have a better fit with SCF that we did not consider. The geographical context is another limitation, because there were only Scottish firms in the sample. A similar focus group could be reproduced in other countries to test our findings in a different geographical context.

Directions for future research

In terms of directions for future research, this article provides several direction of research development.

For single contributions, it highlights potential theoretical background that can provide good lenses for additional empirical or modelling pieces linking supply chain management and finance. For example, TCE or AT can be used as theoretical basis to develop case study applications further investigating the behaviour of suppliers in reverse factoring applications.

For doctoral candidates or early career researchers, there are possibility to develop contributions spanning over multiple articles, investigating theoretical areas that need further development using the integration of supply chain and finance as a potential fertile terrain for fruitful contributions. For example, while CNs and game theory are often connected (Camarinha-Matos and Afsarmanesh, 2005b; Dekkers, 2009), there is a need for further investigation. The interconnection between supply chain and finance has the potential to provide a good basis for a series of contributions in this direction: from a methodological point of view, the recent contribution by Fisher and Aguinis provides excellent guidance towards using empirical evidence in the context of SCF or supply chain an finance integration to make theoretical advancements (Fisher and Aguinis, 2017).

Finally, research groups that want to devote significant attention to the topic of SCF and – more in general – integration between supply chain and finance – might devote their effort towards consolidating the topic as a new scientific discipline, consolidating existing knowledge, clarifying its scope against existing literature and producing an effort towards the definition of a specific research agenda that would be similar to the effort product to differentiate supply chain management from logistics in the early 2000s (Mentzer et al., 2001).

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Table 1: Key theoretical concepts and corresponding evidence from focus group

	Key theoretical concepts	FG1: financial aspects	FG2: relationship	FG3: processes
TCE	Bounded rationality	Purchasing has no finance knowledge	SMEs do not have supply chain perspective	Info available to supplier might be limited
	Potential for opportunism			
	Asset specificity	Assessing financial proposals would take up too much resources Technological needs are not clear		
	Ex ante/ex post transaction cost minimization			
	Alternative modes of governance			
AT	Principal-agent relationship			
	Competing goals (conflicts of interest)	Finance rules over supply chain		SMEs might show scepticism and suspiciousness
	Information Asymmetry			Communication and understanding is key Larger suppliers have knowledge about SCF
	Moral hazard			
	Agency cost		Suppliers might hinder relevant information to avoid seem weak	Supplier asking for money is a sign of weakness and damages the relationship
	Adverse selection			
	Information as commodity		Common standards of evaluation do not include finance	
	Behaviour/outcome based contracts		Right incentive can bring right focus to suppliers	
NT	Relationships ensure access to resources and activities	Only supplier with some degree of strategic relevance can access SCF	SCF has positive impact on relationship with bank (your buyer is investing in you)	
	Interdependency		Larger party dictates terms	
	Centrality		Lack of integration between departments	
	Focus on developing LT trust-base relationships			
	Information and knowledge sharing		Suppliers might hinder relevant information to avoid seem weak	
CNs	Collaborative advantage based on unified approach to value creation ('win-win-win')	Trust comes before SCF		
	Central coordination mechanism (IT as enabler)			Sales is focused on relationship management, finance on transaction
	Network as organism with adjustable structure and phase transitions	Local decisions are limited by HQ policies		
		Suppliers with cash needs are perceived differently based on maturity of relationship	Long term relationships facilitate adoption	
SET	Rewards and costs drive relationship decisions			
	Social capital			
	Power differentiation		There are differences in power btw buyer and supplier Larger suppliers more open than smaller	
	Evaluation standards vary	Ad-hoc evaluation models might be created	Culture affects willingness to discuss finance	
	Development of relationships			Relevance of interpersonal relationships between buyer and supplier
	Positive relationship ensure stability and beneficial outcomes			

A bounded rationality perspective on Reverse Factoring
Insights from Dutch SMEs

Christiaan de Goeij[1], Luca Mattia Gelsomino[1], Federico Caniato[2], Ronald de Boer[1], Antonella Moretto[2] and Michiel Steeman[1]
1 Windesheim University of Applied Sciences, The Netherlands
2 Politecnico di Milano, Italy

Abstract
The objective of this paper is to analyze which factors influence the small- and medium sized suppliers' decisions to accept or reject an offer for reverse factoring (RF) from their buyers. Through a multiple case-study, with the RF offer as the unit of analysis, the research attempts to identify the quantitative and qualitative factors that influence the SME's decision regarding this offer. We interview suppliers, buyers and banks, and make use of secondary data. We contribute to filling in multiple research gaps in SCF about the SME perspective and adoption of RF and provide clear managerial insights for both suppliers and buyers.

Key words: Supply Chain Finance; Reverse Factoring; SMEs.

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Introduction
In recent years, banks have been required to increase liquid assets, resulting in increased difficulty for companies, especially SMEs, to borrow (Ivashina & Scharfstein, 2010). The resulting liquidity scarcity (Ellingsen & Vlachos, 2009) made it more difficult for companies to invest in inventories and raw materials. In this landscape, Supply Chain Finance (SCF) instruments are often presented as solutions for working capital management of both single companies and the supply chains they are part of (De Boer, Van Bergen & Steeman, 2015; Gelsomino, Mangiaracina, Perego & Tumino, 2016; Pfohl & Gomm, 2009).
Revere Factoring (RF) is the most well-known SCF instrument. With RF a large creditworthy buyer allows his suppliers to sell approved invoices to financial institutions based on the buyer's own credit rating (Dello Iacono, Reindorp & Dellaert, 2015; Wuttke, Blome, Foerstl & Henke, 2013). A recent industry survey shows that usage of SCF instruments is growing, and that RF is by far the most used instrument. The same survey shows that for buyers working capital optimization is the most important reason to do RF (Siemes, Extra, Dellermann & Gelsomino, 2017). Therefore, purchasing spend is an important characteristic when choosing suppliers whom to offer RF, and suppliers who represent a large spend might receive an RF offer first. However, since the RF market is maturing and RF is becoming a more standardized practice, onboarding costs decrease which makes it easier for buyers to also offer RF to the 'long tail' of small and medium sized (SME) suppliers. Examples of companies that already offer RF to SME suppliers are Vodafone, Puma and Jumbo (Stammers, 2016; Carlsson, 2016; Marteijn, 2015).

SMEs in the Netherlands represent more than 99,8% of all active businesses, provide 72% of all jobs and 62% of national GDP (Nederlands Comité voor Ondernemerschap en Financiering, 2017). In the Netherlands there are 47 SMEs per 1,000 inhabitants. In comparison: in France this number is 39, in UK 28 and in Germany 27 per 1,000 inhabitants (Centraal Bureau voor de Statistiek, 2015). 51% of Dutch companies have been asked to accept payment terms from their customers that are longer than they feel comfortable with (Intrum Justitia, 2017). These extended payment terms can result into liquidity problems for suppliers. In the light of these potential liquidity problems SCF solutions like RF are often portrayed as a solution for SMEs, and a win-win situation for both buyer and supplier (Klapper, 2006). The attention in both the corporate and the academic world for SCF and RF is growing, but there is a lack of attention for the supplier perspective (Wuttke, 2013a; Lekkakos & Serrano, 2016; Liebl, Hartmann & Feisel, 2016). RF is relatively new for SME suppliers, which is why there is a lack of knowledge among them about the effects (De Goeij, Onstein & Steeman, 2016). Recent research shows that often working capital optimization or reduction of purchasing prices, instead of stabilizing the supply base, are the most important reasons for buyers to introduce RF and therefore, suppliers can't just simply assume that RF will be a win-win situation (Liebl et al., 2016).
Recently the supplier perspective in RF gained some attention (Dello Iacono et al., 2015; Van der Vliet, Reindorp & Fransoo, 2015; Lekkakos & Serrano, 2016; Liebl et al., 2016; Martin, 2017). Dello Iacono et al. (2015) and Van der Vliet et al. (2015) focus mostly on quantitative factors that influence benefits and costs for suppliers in RF. Lekkakos & Serrano (2016) study the impact of RF programmes on suppliers' operational decisions and performance based on a multi-period model and numerical experiments. Only Liebl et al. (2016) and Martin (2017) use empirical data. Dello Iacono (2015) states a match between quantitative 'hard' factors and qualitative 'soft' factors is needed. According to Caniato, Gelsomino, Perego & Ronchi (2016) research should also include unsuccessful adoption cases of SCF solutions to be able to make a better analysis. Therefore, the objective of our paper is to analyze both quantitative and qualitative factors that drive an SME supplier to accept or decline an RF offer from its buyer. This is supported by empirical case study research, wherein both suppliers that accepted and suppliers that rejected an RF offer are included.

Literature review

There is a growing attention for SCF in general, and RF in particular, among academics. The field SCF is relatively new and most papers have been published after 2005. The first papers were conceptual in nature and showed the potential of a collaborative financial approach among supply chain partners (Hofmann, 2005; Pfohl & Gomm, 2009; Randall & Farris, 2009; Gomm, 2010). Later on, a stream of empirical research in SCF and RF followed, mainly focused on the perspective of the focal buyer company in the supply chain (Wuttke et al., 2013a; Wuttke, Blome & Henke, 2013b; More & Basu, 2013; Blackman, Holland & Westcott, 2013; Wandfluh, Hofmann & Schoensleben, 2016; Caniato et al., 2016). Only recently the supplier perspective has gained attention, but most of the contributions on suppliers and SMEs are non-empirical (Van der Vliet et al., 2015; Dello Iacono et al., 2015; Lekkakos & Serrano, 2016) or have only limited empirical input from suppliers (Liebl et al., 2016). An exception is the research of Martin (2017) which shows, based on a survey among 115 Swiss companies, that the supplier's commitment in participating in SCF is not only about quantitative factors, but relational factors like trust, power and dependence are also important. However, Martin (2017) states that in her research only a limited amount of suppliers is included who actually got offers for RF or other inter-organisational financing alternatives, or already implemented it. In general, important factors in the decision process that can lead to the adoption of SCF instruments are often not considered (Caniato et al.,

2016). This is especially true for the supplier perspective, since the amount of empirical data about suppliers is still very limited. Current research touches upon some important quantitative and qualitative factors, but does not show the full picture yet on how suppliers make decisions regarding RF offers. That is why case study research on SME suppliers is seen as fertile area for future research (Wandfluh et al., 2016). The literature on SCF adoption for SMEs has considered several factors, which can be grouped in the following four categories: bounded rationality, quantitative factors, buyer-supplier relationship status and the supplier's relationship with financial institutions (Hofmann & Kotzab, 2010; Van der Vliet et al., 2015; Liebl et al., 2016; Wuttke et al., 2013). In the underlying these factors will be explained in more detail.

Bounded rationality

Regarding bounded rationality, Wuttke et al. (2013a) mention that buyers experienced spending much time on explaining the concept of RF to suppliers who haven't heard of it before. Also De Goeij et al. (2016) mention supplier's unfamiliarity with RF as one of the major impediments for adopting RF. This is why Wuttke, Henke, Heese & Protopappa-Sieke (2016) state that the supplier's experience with and exposure to successful SCF business cases is important in SCF adoption. Martin (2017) shows also experience with other similar financing options like factoring, are relevant for suppliers to know how to evaluate terms and conditions in SCF. Many papers on SCF mention cross-functional collaboration within the buyer company is needed (i.e. Wandfluh et al., 2016). However, this is also important for suppliers. Wuttke et al. (2016) mention that when buyers introduce RF to suppliers they usually first talk with sales managers, but there is often an absence of explicit incentives for sales people since RF does not lead to increased prices or reduced payment terms. Therefore, it requires sales people to collaborate with internal financial people to get a better idea about company benefits. In an SCM context, Simatupang and Sridharan (2005) show the importance of information sharing for alignment on incentives and decisions. Wandfluh et al. (2016) state that information sharing between buyer and supplier, or the lack of it, is also an important success factor for SCF. De Boer et al. (2017) show in the context of SCF there can be a reverse principle-agent situation in buyer-supplier relationships, as financial flows move in opposite directions and there are conflicting goals, for example about payment terms. The buyer has more information, for example about invoice approval, but might act against the principal's (supplier's) best interest by not sharing relevant information in order to pay late. Because the supplier does not have full information, he cannot make an optimal decision regarding an SCF offer from the buyer. Martin (2017) shows that suppliers can be uncertain on future terms and conditions as well as on reasons for buyers to provide them with a financing alternative, and mentions these uncertainties can hinder rational decision making.

Quantitative factors

Pfohl & Gomm (2009) introduced the supply chain finance cube, a three-dimensional framework to assess benefits for SCF. Included are three aspects: the amount of assets (volume of financing) that needs to be financed, the duration of financing and the capital cost rate. With RF a buyer and its financier offer credit to a supplier, against the credit rating of the buyer (Demica, 2007). If the buyer has a high credit rating, the supplier enjoys low short-term financing costs. However, often when RF is introduced to a supplier, this goes together with an extension of payment terms and a discount on the invoice (Wuttke et al., 2013a; Liebl et al., 2016). Van der Vliet et al. (2015) show that a supplier needs to carefully assess if the benefits from making use of the credit rating of the buyer aren't offset by the negative financial implications of the payment term extension and the discount the supplier gives on

the invoice. Dello Iacono et al. (2015) state that ideally also the benefits and costs of competing forms of financing and training costs for getting familiar with RF should be included when assessing benefits and drawbacks of RF for suppliers, but do not include these aspects yet in their model. Regarding the latter, De Boer et al. (2017) report about suppliers who did not understand forms of SCF at first, and therefore had implementation costs such as learning costs and costs for legal advice.

Supplier-buyer relationship

Regarding supplier-buyer relationship, literature shows how a good relationship, based on shared information and trust, is an important requirement for effective supply chain management (Handfield & Bechtel, 2002; Horvath, 2001). This also applies to SCF: according to Wuttke et al. (2013a), the absence of trust reduces the supplier's willingness to adopt RF. Furthermore, power distribution, influenced by volumes, the specificity of purchased goods and intensity of competition in the market (Liebl et al., 2016) is known to influence the adoption of SCF. According to Hofmann & Kotzab (2010) an uneven distribution of power can be a big burden towards collaborative SCF approaches. In some cases the buyer has much more power than the supplier, and the buyer dictates terms in SCF contracts (Wuttke et al., 2013a). In other cases where power is more equally distributed or where the supplier has more power, buyers care more about the relationship, the approach towards suppliers is more customized and the main goal of the buyer is not extension of payment terms or reduction of purchasing prices (Liebl et al., 2016). Caniato et al. (2016) show that RF can have a collaborative function and can be used as a risk management tool for buyers, to secure the supply base. For suppliers, a long-term collaboration can be a requirement for adopting RF. However, there are also suppliers that consider RF as an instrument that increases their dependency on the buyer, which may lead to a worsened negotiation position for discussing prices (Liebl et al., 2016).

Supplier – banks relationship

Finally, some papers mention the role of the relationship between the buyer's bank and the supplier in adopting RF (Liebl et al., 2016; Wuttke et al., 2013). Wuttke et al. (2013) report on suppliers that expect "there is *a catch to SCF, as they did not trust an external bank they are currently not doing business with*". This shows that, for suppliers, it can be unclear what the consequences of RF are when buyers enlist a different bank. RF operations always involve the bank of the buyer, while often the supplier might have a pre-existing relationship with a different bank. Access to other types of financing, like bank loans or factoring, influences the willingness of a supplier to participate in an RF program (Lekkakos & Serrano, 2016; Martin, 2017). Consequently, the approach of a supplier towards RF can be affected by the pre-existing relationship with its own bank. But, as far as we know, there is no research yet about the effects of this relationship.

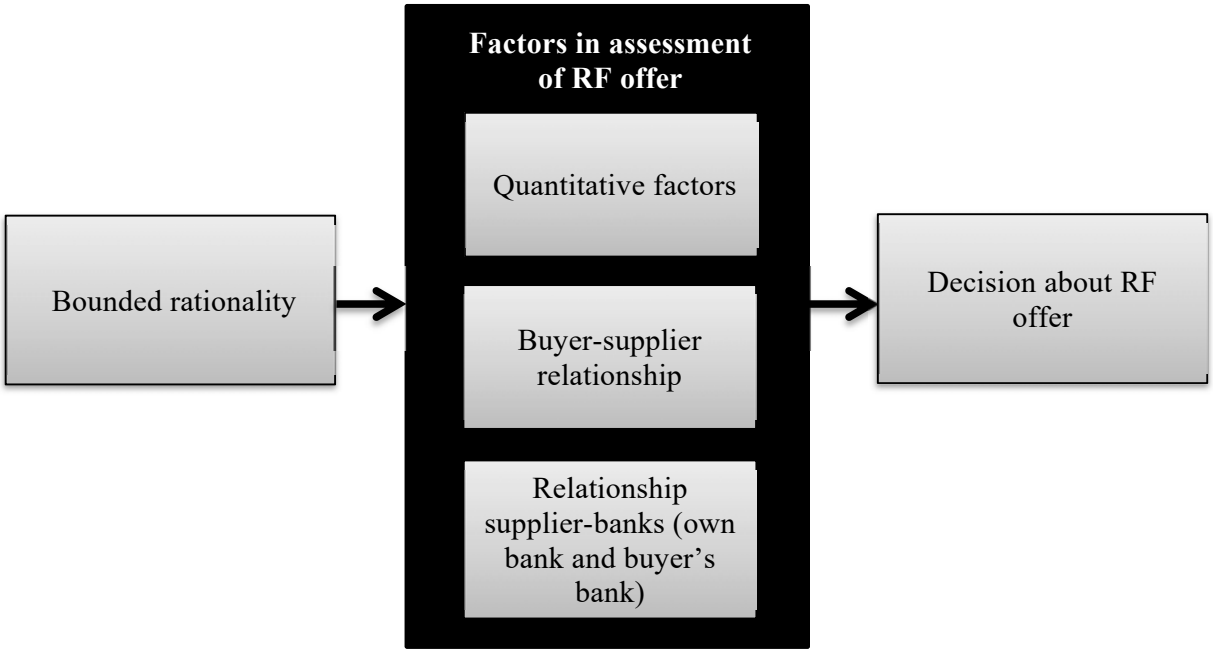
Table 1: Factors and subfactors influencing SMEs decision on RF from literature

Factor	***Subfactor***	***References***
Bounded rationality	• *(Lack of) Knowledge*	*More & Basu (2013), Wuttke et al. (2013a), De Goeij et al., (2016)*
	• *Prior experience*	*Wuttke et al. (2016); Martin (2017)*
	• *Cross-functional collaboration*	*Wuttke et al. (2016)*
	• *(Lack of) Information sharing with buyer*	*Wandfluh et al. (2016); De Boer et al. (2017); Martin (2017)*
Quantitative factors	• *Volume, duration and capital cost rate*	*Pfohl & Gomm, 2009*
	• *Payment term extension and discount on invoice*	*Van der Vliet et al., 2015*
	• *Competing forms of financing*	*Dello Iacono et al., 2015; Martin, 2017*

	• *Implementation costs*	*De Boer et al., 2017; Dello Iacono et al., 2015*
Buyer-supplier relationship	• *Trust* • *Power balance*	*Wuttke et al. (2013a)* *Hofmann & Kotzab (2010); Liebl et al. (2016);*
Supplier-banks relationship	• *Trust in bank buyer* • *Access to alternative finance from own bank*	*Wuttke et al. (2013a)* *Lekkakos & Serrano (2016)*

Figure 1 shows a conceptual supplier decision making framework, that consists of the constructs in Table 1 The direct factors influencing the decision for a supplier to accept or reject an RF offer from a buyer are quantitative factors, the buyer-supplier relationship and the relationship with both the own bank and the buyer's bank. Bounded rationality influences the supplier's assessment of the three previously mentioned factors. For example the lack of knowledge of suppliers about RF, reported on by Wuttke et al. (2013a) and De Goeij et al. (2016), can result into suppliers not being able to do a good assessment of quantitative effects of RF or of the effects of RF on relationships, with both buyers and banks.

Figure 1: Conceptual RF supplier decision making framework



The framework leads to the following two research questions:

RQ1: How do quantitative factors, the buyer-supplier relationship and the relationship between suppliers and banks influence a supplier's decision about a buyer's RF offer?

RQ2: To what extent does bounded rationality influence the supplier's assessment of the effects of the buyer's RF offer on quantitative factors, the buyer-supplier relationship status and the relationship between suppliers and banks?

Methodology

The methodology includes 8 case studies, wherein the Reverse Factoring offer is the unit of analysis. Case study methodology is suitable, because of the exploratory nature of this research (Yin, 2003). When the preceding theoretical foundation is not strong yet, case studies can offer an advantage (Edmondson & McManus, 2007).

Case selection

The case studies comprised 8 offers of RF, with 5 suppliers and 6 buyers involved in these offers (see table 2). The suppliers in the sample are in transportation or in food industry. There are buyers involved which are bike producers, retailers and furthermore logistics service providers working with subcontractors for transportation. There are two suppliers included who got more than one offer from different buyers. Also, there are three suppliers included who got an RF offer all from the same buyer. These three suppliers were all subcontractors, doing transportation for this buyer which is a larger LSP. All of the 5 suppliers are SMEs with a yearly turnover ranging from €2,5m - €30m. All of the 6 buyers are large companies with a yearly turnover ranging from €600m - €17,2bn. The case sample includes cases in which the supplier accepted the RF offer, but as suggested by Caniato et al. (2016) also takes unsuccessful adoption into account, by including cases in which suppliers rejected the RF offer.

Table 2: Characteristics of all 8 RF offers

RF Offer	Supplier	Industry	Buyer	Industry	Supplier decision	Data collection
RFO1	S1	Transportation	B1	Bikes	Y(es)	Interviews with S1 and B1, secondary data
RFO2	S2	Food	B2	Retail	Y	Interviews with S2 and B2, secondary data
RFO3	S2	Food	B3	Retail	N(o)	Interviews with S2 and B3, secondary data
RFO4	S2	Food	B4	Retail	N	Interviews with S2 and B4, secondary data
RFO5	S3	Transportation	B5	Logistics	Y	Interviews with S3 and B5, secondary data
RFO6	S4	Transportation	B5	Logistics	Y	Interviews with S4 and B5
RFO7	S5	Transportation	B5	Logistics	Y	Interviews with S5 and B5
RFO8	S5	Transportation	B6	Logistics	N	Interview with S5

Data collection

We chose a dyadic approach, by doing interviews with both the suppliers and buyers. Semi-structured interviews were conducted, because they provide flexibility for exploring phenomena that have not been studied extensively yet (Da Mota Pedrosa, 2012). Triangulation took place, mainly because of the usage of lots of secondary data. For most cases we were able to see the actual RF contract that the buyer proposed to the supplier. Other sources of secondary data are contracts between suppliers and banks, contracts between suppliers and credit insurers, calculation models of suppliers, internal financial reports, invoicing data and information coming from e-mail communication between suppliers, buyers and banks. Furthermore triangulation took place, because not only buyers and suppliers were interviewed, but also two banks who were involved in multiple RF offers. Interviews were conducted with key personnel involved with the RF offer. In most cases more than one department was included in the interview(s). On the supplier side these interviews were done with sales managers, financial managers or controllers and in the case of S3, S4 and S5 the directors/owners of the company. The employees interviewed from buying companies were procurement and financing managers or controllers.

Coding and data analysis

After collection of the data we started with open coding. Our strategy for coding was first to allow researchers involved to code the data independently, as suggested by Baxter and Jack (2008). All the involved researchers have then met to come to a consensus on categories and groups. We then matched patterns among cases. In this phase both interview reports and secondary data were used. The first results were reviewed by researchers and other participants in the research project, thus decreasing the likelihood of false reporting (Yin, 2003). The data collected from the different sources were related to existing literature on SCF, according to our research framework represented in Figure 1, to help us analyze which factors and linkages are related to existing literature and which ones are new. After that a

cross-case analysis was performed by comparing the various cases along each factor, in order to identify groups of cases with similar outcomes.

Results

This section will first of all provide an overview of how the four factors appear in the 8 RF offers via Table 3. After that RQ 1 and 2 will be answered, by analyzing the linkages between the decision of the supplier and the quantitative factors, the supplier-buyer relationship and the supplier-banks relationship, and finally the linkage between bounded rationality and the supplier's assessment of the three assessment factors.

Table 3: Prevalence of relevant factors in the RF offers

Factor → RFO	**Bounded rationality**	**Quantitative factors**	**Supplier-buyer relationship**	**Supplier-banks relationship**
RFO 1	No prior experience with RF for S1. S1 at first did not know how to assess quantitative effects RF. S1 is insecure about what the effect of doing RF with the buyer's bank will be on the relationship with the own bank.	In terms of financing costs RF shows very slight improvement in comparison with old situation. B1 represents large volume, difference in invoice approval after i.e. 5,10 or 15 days is big. Very important B1 can approve invoice fast. Accepting RF means losing 'cashflow flexibility' in comparison to factoring wherein they got money after 2/3 days.	This is the largest customer of S1, S1 fears rejection of the offer will harm the relationship. B1 included S1 as one of the first suppliers in their pilot RF programme. S1 thinks accepting the offer is 'giving something to the buyer', and can be beneficial in the future to 'get something back for it when discussing terms'.	S1 had factoring solution in place with own bank before RF with the buyer's bank was introduced. Accepting RF means the own bank will lose a large volume in their factoring portfolio. S1 fears this will have negative consequences in the future when discussing terms with the own bank.
RFO 2	First RFO for S2. Supplier at first did not know how to assess quantitative effects RF, in particular the effect of the discount rate was largely underestimated. Sales is main department involved, not familiar with typical financial matters. Not much collaboration sales and finance dept.	In terms of financing costs RF shows a very small improvement in comparison with old situation.	Lack of trust was the main reason for S2 to reject the RF offer. They felt main reason for doing RF for B2 was payment term extension. Furthermore, B2 couldn't answer S2's 'what if' questions. For example, what if banks step out of contract, what if Euribor goes up etc. B2 stated explicitly that accepting RF would not be a strategic benefit for S2 in comparison to supplier who would reject.	S2 is owned by a private equity group, who is supplying S2 with loans. RF would replace this loans partially, which S2 describes as not feasible for the private equity group. S2 thought that involved buyer bank could was generic, and not detailed enough about RF explanation.
RFO 3	Second RF offer for S2, came very soon after RFO2. Sales main department involved, not familiar with typical financial matters. Not much collaboration sales and finance dept.	In terms of financing costs RF shows a very small improvement in comparison with old situation.	Just like with B2, the supplier felt a lack of trust regarding the RF offer of B3 and felt that B3 could not take away their doubts well enough	S2 is owned by a private equity group, who is supplying S2 with loans. RF would replace this loans partially, which S2 describes as not feasible for the private equity group.
RFO 4	Third RF offer for S2. S2 had calculation models in place for assessing quantitative effects and gained much background info about qualitative factors.	In terms of financing costs RF shows a very small improvement in comparison with old situation.	Trust in B4 was the main reason why S2 accepted the offer. They felt B4 had a collaborative approach, and that B4 was very open and honest about the reasons of introducing an RF programme.	S2 is owned by a private equity group, who is supplying S2 with loans. RF would replace this loans partially, which S2 describes as not feasible for the private equity group.
RFO 5	First RF offer for S3, no prior experience. S3 did extensive calculations of possible quantitative effects RF and also overthought effects in terms of relation with buyer. Did not understand motives of buyer.	In terms of financing costs RF shows slightly negative effects. B5 told S3 that costs of RF could be neutralized by making sales price higher.	Buyer is most important customer. This is main reason why S3 accepted the offer. Trust was not immediately there, since S3 felt this was mainly a way to extend payment terms. S3 felt that for B5 it was of strategic importance as many suppliers as possible accepted RF.	S3 finances itself with equity and almost never needs bank finance. S3 felt explanation by the bank of the buyer was very generic at first, and did not go into depth about possible risks and long-term effects.
RFO 6	No prior experience. Learned about RF from a business contact in other company (director of S3).	Expected effects by S4 were positive, since 'it could make use of much better credit rating of B5'. However, no calculations to back this up.	Buyer is most important customer, represents large part of sales volume. Owner of S4 has long history	"Buyer's bank is large, well-known bank which makes me think this RF contract will be not much to worry about."

	S4 did not spend much time on calculating effects or overthinking other effects. Accepted the offer quickly based on trust in buyer.	B5 told S4 that costs of RF could be neutralized by making sales price higher. Cashflow effect allows for flexibility: having money available quickly is important.	with owners of B5. Therefore, he has a lot of trust in B5, which is the main reason for accepting the offer.	S4 finances itself with equity and only occasionally needs bank finance, via making use of overdraft facility.
RFO 7	Prior experience, RFO 8 was first experience. Just like S4, S5 also learned about RF effects via business contact which was director of S3.	In terms of financing costs RF shows slightly negative effects. B5 told S5 costs of RF could be neutralized by making sales price higher. This was crucial for S5 before accepting the offer.	In terms of sales volume B5 is not a large customer for S5, S5 has a diverse base of clients.	S5 finances itself with equity, almost never needs bank finance. Relation with buyer's bank or own bank was not considered a factor in the decision making.
RFO 8	No prior experience.	In terms of financing costs RF shows slightly negative effects. S5 wanted costs of RF to be neutralized by making sales price higher. This was not possible, which is an important reason why S5 rejected the offer.	S5 has a diverse base of customers, even though B6 is the largest customer, it doesn't represent a large percentage of total sales volume for S5.	S5 finances itself with equity, almost never needs bank finance. Relation with buyer's bank or own bank was not considered a factor in the decision making.

In answering *RQ 1*, what becomes clear from the 8 cases is that quantitative factors have an impact on the supplier's decision, but not always a decisive one. There are RFO's rejected by suppliers which showed positive quantitative effects (i.e. RFO 2 and 3) and RFO's accepted by suppliers with negative quantitative effects (i.e. RFO 5). The quantitative factors which play the most important role are, as expected, mainly related to volume, duration (and length of extension of payment terms) and the discount on the invoice. Implementation costs are mainly there in the form of time spent figuring out the RF offer, but in none of the cases play a decisive role for the decision making. In the cases of RFO 1 and RFO 2,3 and 4 alternative forms of financing play a role in decision making, especially in RFO1 wherein S1 had a factoring solution in place before RF. Furthermore, the effects of RF on direct cashflow and flexibility in terms of future spending are considered by especially S1 and S4. For S1 RF is seen as negative for cashflow flexibility, since they had a factoring solution before which allowed them to get their money after day 2 or 3, and with RF they have no guarantee for invoice approval time and will maybe have to wait 15 days. S4 sees RF as a positive influence on cashflow, since it provides them more quickly with money in comparison with the situation before RF, and therefore with the flexibility of doing investments quicker.

The buyer-supplier relationship is often the most important for the decision making of the supplier. As mentioned before RFO 2 and 3 showed small positive quantitative effects, however S2 did not feel enough trust to accept the offers. RFO 6 shows that trust can also be a positive motivator for decision making, the supplier involved knows the buyer for a long time and accepted the offer without much hesitation. In other cases power distribution is decisive, for example for S1 and S3 the strategic importance of the customer was an important reason to accept the RF offer. S5 is an example of a supplier who felt comfortable to reject an RF offer, because B6 was not seen as a company which had enough buying power in this relationship to demand acceptance of the offer.

Furthermore, the cases also show the importance of supplier-banks relationship as a factor. This was most striking in RFO 1 where S1 had factoring in place with the own bank. Changing from factoring to RF meant the own bank lost a large volume in factoring. Therefore, S1 fears there will be negative effects when future terms are discussed with the own bank. S2 is owned by a private equity group, which usually provides them with financing. RF would replace this loans partially, which S2 describes as not feasible for the private equity group. When suppliers finance themselves using equity and barely using bank

credit (RFO 6 and 8), the relationship with the own bank is not important for the decision making. Furthermore, there are suppliers describing that they expected more or a better explanation from the buyer's bank about the RF offer (RFO 2 and 5), and that this was a reason for them to be skeptic about the offer.

To answer *RQ2* we start with the role of prior experience and exposure to other SCF cases, as reported by Wuttke et al. (2016), in decision making, since it plays an important role in the assessment of factors. For example, in RFO 4, for S2 it was easy to calculate quantitative effects since they had a model in place after two earlier RFO's, and were able to ask more precise questions regarding possible effects. For both S4 and S5 RF was new, but the owners of both companies learned about the effects of RF from the director of S3, a mutual business contact. Both S4 and S5 explained this helped them a lot in understanding RF. No prior experience usually means that decision makers need to gain financial advice within the company. RFO 2 and 3 show that this can be difficult, since for S2 it was the sales manager who was involved in the discussions, who did not have much internal incentives related to finance and a lack of financial knowledge. Because the relevant financial employees from the company were working in a different office, in a different country, with different KPIs, the sales-finance collaboration regarding RF was a challenge. In RFO 2,3 and RFO 5, both S2 and S3 questioned the motives for B2,3 and 5 to do RF and thought they did not get full information from these buyers and the banks of the buyers involved. This shows lack of information sharing, and reveals an agency problem. RFO 6 stood out in these 8 cases, S4 explicitly mentioned not having much knowledge about RF but still accepted the offer without spending much time reviewing the effects, since S4 trusted both the buyer and the buyer's bank. Also supplier-banks relationship is a factor influenced by bounded rationality. This was most prevalent in RFO 1 wherein S1 was unsure about what doing RF with the bank of the buyer would mean for the relationship with the own bank, since their own bank would lose a significant piece of their factoring volume.

Conclusion

With this empirical research we aim to contribute to filling in the research gap in SCF literature about the SME supplier perspective. By building on recent studies – e.g. (Dello Iacono et al., 2015; Van der Vliet et al., 2015; Lekkakos & Serrano, 2016; Liebl et al., 2016; Martin, 2017) – we provide further findings on the adoption of SCF by suppliers. By taking both qualitative and quantitative factors into account and showing how they relate to each other, we aim at giving a new perspective on the topic of the supplier decision to accept or reject an RF offer. Our research shows that in terms of quantitative factors an RF offer might have negative consequences for an SME supplier, but the supplier might still accept that same offer because of qualitative factors. Also, an RF offer might be beneficial for an SME supplier in terms of quantitative factors, but the supplier might still reject the offer because of qualitative factors.

This shows some clear managerial insights, for both suppliers and buyers. First of all, for suppliers it shows that in the decision they also have to take qualitative factors into account. There can be expected positive effects in terms of financing costs, but unclarity in terms of both quantitative effects and relationship effects. For example, unclarity about approval time of invoices, about what RF will mean in terms of financial dependence on the buyer or what RF will mean for the relationship with the own bank when it replaces and old form of financing. Suppliers which expect more than one RF offer from buyers will benefit from making use of calculation models to make a good assessment of effects. For buyers, it becomes clear that suppliers can be skeptic when they feel the main reason for buyers to do RF is payment term extension. Especially, suppliers seemed to be more skeptic about RF in

cases wherein the buyer's bank, and not buyers themselves, took a leading role in approaching the supplier.

Limitations of this paper are first of all the focus on only Dutch SMEs, and second the focus on mainly two sectors (retail and logistics). Future research might benefit from taking place in other countries and other sectors. The research is exploratory with theory-building as the main goal, but theory-testing is an important next step. Furthermore, there is now an amount of papers about initiation and adoption of RF, but there are no papers yet about the phase *after adoption* of RF. It is interesting to see what the real benefits for SMEs are after RF is adopted, since our research shows SMEs do not always get full clarity on the buyer's offer during the initiation or adoption phase. This also shows us that more research on the agency problem in SCF is needed, since information sharing is an important success factor in SCF. Lastly, research on SCF will benefit from looking at other, more innovative, ways of doing SCF that gradually appear in industry, for example with a pre-shipment focus instead of a post-shipment focus.

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Supply Chain Resilience: an earthquake investigation in the Italian Biomedical industry from a multi-tier perspective

Mattia Donadoni[1] - *mattia.donadoni@polimi.it* - +39 02 23993991
Federico Caniato[1] - *federico.caniato@polimi.it* - +39 02 23992801
Raffaella Cagliano[1] - *raffaella.cagliano@polimi.it* - +39 02 23992795

(1) Politecnico di Milano, School of Management, Piazza Leonardo da Vinci 32, 20133 Milano (Italy)

Supply chain resilience has acquired relevance through the last decades as the primary capability for facing disruptive events. This work aims to shed lights on how resilience is pursued within the supply chain by investigating the relationships across stages and the changes brought due to the occurrence of disruption. Three supply chain stages (focal companies, first and second tier suppliers) in the Italian Biomedical industry have been involved in the analysis. Findings suggest how resilience is approached differently across tiers, but the importance of coordination is highlighted as the main driver for improving the mitigating capacity of the whole chain.

Keywords: Supply chain resilience, disruptions, Biomedical industry

Submission category*:* Competitive paper

Introduction

The ability to face disruptive events and recover from them has become a crucial capability in today's business scenario. Over the last decades, companies have proven themselves through unpredictable events that have challenged their ability to fulfil business objectives. Indeed, the frequency of disruptive events is exaggerated by the global partnerships established for achieving better products at the lowest cost. This trend exposed companies and their supply chains to a higher level of complexity and vulnerability due to a dense interconnection of companies worldwide (Christopher & Peck, 2004; Knemeyer et al., 2009; Hohenstein et al., 2015; Tukamuhabwa et al., 2015). Indeed, once a disruption occurred in a single node, can jeopardise the ability of the entire network to fulfil its requirements by affecting the capacity to tied up the elements that constitute the system (e.g. domino effect).

Resilience is the capability that academics coined for describing the ability to absorb and bounce back from such disruptive events. Over the years, resilience has gained consistency in the academic landscape as a peculiar characteristic to be designed into organisations and supply chains for driving the ability to survive in complex and vulnerable business scenarios (Hohenstein et al., 2015; Kamalahmadi & Parast, 2016). As Ponomarov and Holcomb (2009) detailed highlights in their work, the concept of resilience has changed according to the field in which has been applied (e.g. ecological, social, psychological and economic). In the management one, the term refers to the adaptive capacity of a system to face problems and recover from them by maintaining some level of control and stability (Weick et al., 2008). To this extent, a supply chain can be seen as a system in which the ability to deal with disruptions and bounce back from them is essential for avoiding interruption in the flow of information and materials.

This work aims to provide insights on the changes in the resilience approach in the supply chain brought by the disruptions occurrence from a multi-stage perspective. Specifically, a deep investigation of the strategies applied in three phases of the disruption curve (before, during and after) is provided. Coupled with an analysis of how resilience is influenced within the supply chain. Hence, the purpose becomes unveiling the relationships across supply chain stages when resilience must be pursued. To achieve the research objectives, we targeted the Italian Biomedical industry as the area experienced two huge earthquakes in 2012 that have tested the ability of such companies to face unpredictable events. Specifically, we were able to involve ten companies in three different supply chain stages: focal companies, first tier suppliers and second tier suppliers. The structure of the paper is the following. First, we provide the conceptual background required for understanding the elements analysed in this work. Second, we explained the research design regarding research background and research questions formulated. Then, we moved to describe the methodology on which this work is based. Finally, findings and discussion of them are provided. The paper concludes by outlining limitations and suggestions for further research.

Conceptual Background

Disruptions are severely affecting companies all around the world in today's business environment. Simply, disruptions are “unplanned and unexpected events that interrupt the flow of materials and products within a supply chain” (Hendricks & Singhal, 2005). To this extent, a certain degree of unpredictability into supply chains is brought due to a highly interconnected network of companies that lead disruptions spread across supply chains (Fiksel et al., 2015).

For counteracting the detrimental effects of such disruptive events, the concept of supply chain resilience was coined as the crucial capability that must be designed into supply chains. Supply chain resilience is defined as “the adaptive capability of a supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function”

(Ponomarov & Holcomb, 2009). As noticed in the early theoretical contributions in the field of supply chain resilience, the concept of resilience is multidisciplinary one that has found several applications in heterogeneous fields (Ponomarov & Holcomb, 2009).

Supply chain resilience entails a broader perspective of how companies must improve their ability to bounce back from disruptions at the supply chain level rather than company one. Indeed, once a disruption occurs, the negative outcomes tend to spread even outside the boundaries of company level up to the supply chain (Craighead et al., 2007; Stonebraker et al., 2009). Besides, the globalisation has even worsened the situation due to the possibility that those detrimental outcomes can spread at network level since supply chains are always more related. Given the Ponomarov & Holcomb (2009) definition, supply chain resilience can be operationalised through three phases: readiness, response and recovery.

The first phase entails what companies do before a disruption occurs. So, strategies that are applied proactively having in mind how it is important to improve capacity to face problems in advance, in order to be ready once a disruption happens. Response entails the mitigate power of companies to treat the problems. In this phase, the disruption already occurs, and its detrimental outcomes are fully revealed. So, it is vital being able to deployed strategies aimed to counteract such negative effects. Finally, but not less important, the recovery phase in which the goal is going back to the original performance level (e.g. before being disrupted).

So far, supply chain resilience can be ensured by creating the concept of capability. Indeed, according to previous supply chain resilience works, companies by combining tangible and intangible resources aims to foster resilience in the supply chain.

As pointed out in the systematic literature review by Tukamuhabwa et al., (2015), works published in the last decades have focused on enriching the list of potential practices and relative capabilities that can lead to resilience. To this extent, the most refer one are flexibility, redundancy, collaboration, visibility and risk management culture.

Flexibility embraces the view of changing quickly to balance unpredictable changes in the environment. To this extent, flexibility improves resilience as a consequence of the improved company's ability to quickly adapt (Fiksel, 2006). Redundancy has been previously defined as the cornerstone of resilience. Indeed, the trigger works on resilience (e.g. Rice & Caniato, 2003 or Christopher & Peck, 2004) built their argument built around of concept of redundancy. Indeed, having extra capacity and inventory become a strategic move especially during disruptions occurrence (Tukamuhabwa et al., 2015). As redundancy can guarantee the ability to deal with both expected and unexpected peaks in demand that can cause shortages (Christopher & Peck, 2004). Collaboration entails two or more people working together towards a common goal. Within the resilience domain, that goal is the ability to deal with disruptions and recovery from them. Collaboration becomes an essential capability needed since resilience can only be achieved through cooperation in the supply chain. Aligned with the collaboration concept, it is possible to introduce the idea of visibility which is grounded on the possibility to observe and capture variations within the supply chain. Visibility can be defined as “the ability to see from one end of the pipeline to the other” (Christopher & Peck, 2004). As previous works have shown, visibility improve transparency that in turn, improves resilience by reducing the misalignment among actors in the chain. In this way, actions and effort worthless are reduced, and resilience is fostered (Christopher & Lee, 2004; van der Vorst & Beulens, 2002).

Finally, Rice and Caniato (2003) introduced how companies should foster an internal ability to highlights risks whatever it takes. To this extent, the concept of risk management culture embraces the idea that each employee should prioritise the identification of risks and their sources on a daily basis. Indeed, people have the power to anticipate disruptions consideration before disruption happened improving resilience.

Research Design

Research Objectives and Questions

Supply Chain Resilience has shown the importance both in academics and practitioners landscape. Given its importance, supply chain resilience is yet a complex and difficult phenomenon to be disentangled (Hohenstein et al., 2015; Tukamuhabwa et al., 2015). So far, scholars have worked on conceptualising resilience by identifying what companies can do for improving resilience (e.g. what kind of practices, which capabilities to foster within organisations) but few works have deeper the analyses by targeting a real disruptive event occurred, understanding how the supply chain responded and recovered from such event (Latour, 2001; Leat & Revoredo-Giha, 2013).

Besides, there is a lack of knowledge regarding the dynamic nature of resilience in which the overall resilience achieved in the supply chain is grounded on a relational link between stages. Indeed, the resilience approach pursued in one supply chain stage may influence the one achieved in others, or it may be driven by choices upstream and downstream in the supply chain. This work aims a twofold goal. First, we want to understand how companies shape their resilience approach in the face of the occurrence of a disruption event. To this extent, we aimed to characterise what companies did for overcoming such disruptive event within the three phases (readiness, response and recovery) through which resilience is created from a multi-stage perspective in order to provide a real understanding of how resilience is fostered within the supply chain. Second, we aimed to shed light on the dynamic nature of supply chain resilience by investigating the relationships among supply chain stages concerning the resilience approach deployed. The research questions to be addressed are:

RQ 1: How is supply chain resilience affected by disruptions?
RQ 2: How is supply chain resilience dynamically shaped across various stages of the supply chain?

In order to answer the research questions, this study focuses on the Medical Device Supply Chain in Italy as a context of study given the two earthquakes that affected the northeast area in Italy in 2012. Furthermore, we involved in the analysis companies belonging to three supply chain stages: focal companies, first tier suppliers and second tier suppliers.

The research question 1 (RQ 1) is intended to be answered per supply chain stage, that is, to identify the resilience practices applied at each stage of the supply chain. Instead, the second research question (RQ 2) is to be answered at the supply chain level for capturing how the resilience approach of one stage brings changes elsewhere upstream and downstream.

Research Question 1: resilience approach changes due to the disruption event

The first research question (RQ 1) intends to characterise how the disruption events affected the resilient approach of companies. To this extent, the resilience approach depends on a set of practices adopted and the relative capabilities shaped. Doing so, we aim to provide insights on how the resilience approach in the supply chain depends on the occurrence of a disruptive event since such disruption might change the perception of the strategies required within the supply chain.

Specifically, we analysed the resilience practices put in place before, during and after the earthquakes (Figure I).

Table I shows the taxonomy adopted for identifying the practices and relative capabilities created. To this extent, we combined different theoretical contributions (e.g. Rice & Caniato, 2003 and Jüttner & Maklan, 2011). First, we started from the most common proposed capabilities in the SCRES literature such as flexibility, redundancy, visibility, collaboration and risk management culture. Then, we focused on the list of practices that contribute to creating

the capability. Finally, we enriched the list of practices in each capability by drawing from different contributions (Pettit et al., 2010; Hohenstein et al., 2015; Tukamuhabwa et al., 2015).

Research Question 2: relationships among supply chain stages
The second research question (RQ2) provides a wider and deeper sense of supply chain resilience. Indeed, the objective is to provide insights on how resilience within the supply chain is dynamically shaped. Companies working in different supply chain stages may influence the way through which companies achieved resilience. Specifically, the relationships between stages may define the overall resilience of the supply chain since the practices applied by one tier may have consequences in those applied elsewhere.

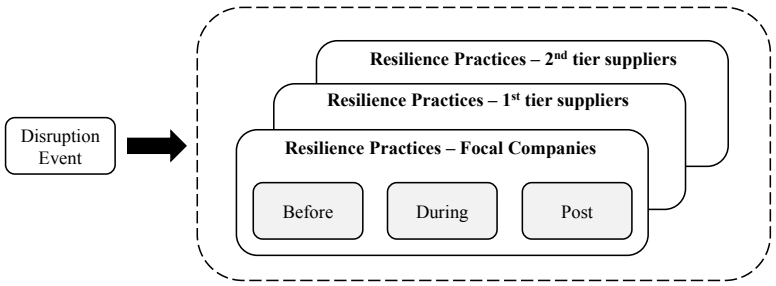

Figure I - Research framework developed for RQ 1

By considering resilience as a multitude of capabilities, such capabilities achieved in one stage of the chain may reinforce with others in different supply chain stages. Thus, answering the second research question will provide useful insights on the in interdependencies across supply chain actors that drive SCRES.

Theoretical Background
Resource dependence theory (RDT) embraces the idea that companies create a dense network for reducing uncertainty and dependency between supply chain partners (Pfeffer & Salancik, 1978). Specifically, RDT proposes how relationships must be managed effectively since, in today's globalised world, companies rely on others for acquiring resources (e.g. goods, materials) needed to match customer demand (Pfeffer & Salancik, 1978).
RDT has been applied in the supply chain field for describing how companies can easily become dependent on each other as a consequence of the fact that they work towards a common goal. To this extent, even if the dependency is increased, some companies increase their power within the boundaries of the supply chain (Crook & Combs, 2007). Such the interdependencies created within the supply chain are constraints that can be overcome through collaboration. To this extent, RDT shares the idea that such collaboration can reduce uncertainty in the supply chain (Pfeffer & Salancik, 1978). Thus, RDT will be applied in this work for disentangling how resilience is dynamically influenced by what companies do at the different levels of the supply chain. Specifically, RDT highlights the inter-organisational relationships between supply chain actors that will be investigated as the key lens for explaining resilience at the supply chain level (Pfeffer & Salancik, 1978).

Research Methodology
This work entails a case study methodology applied for investigating phenomena in the real world (Eisenhardt, 1989; Voss et al., 2002; Eisenhardt & Graebner, 2007; Yin, 2013). As

suggested in the Operation Management (OM) field, we followed an inductive research approach that aims to build theory (Barratt et al., 2011).
Besides, the Critical Incident Technique (CIT) has been deployed for targeting the scope of the analysis on specific events occurred in the past and facilitating the enquiry of interviewees (Flanagan, 1954). Indeed, as suggested in the seminal paper of Flanagan (1954), the main objective of CIT is to target an incident as the scenario for conducting research. Thus, the outcome becomes a deep analysis of any variations that can explain the subject under investigation (e.g. resilience).
CIT becomes essential for analysing the disruption events that affected the Italian Biomedical industry as we embraced a retrospective nature. To this extent, the CIT method helps to guide respondents by focusing on a specific event for gathering further details regarding what companies did for facing such devastating events (Chell, 1998) having in mind the scenario under inquiry.

Table I - List of resilience practices and relative capabilities (adapted from Pettit et al., 2010)

Capability	**Practices**
Flexibility	Postponement; Modularity and interchangeability; Process Redesign; Supplier contract flexibility; Product differentiation; Portfolio diversification and Input commonality
Redundancy	Reserve Capacity (Safety stock, Multiple sourcing, Extra-production capacity); Distributed capacity & assets; Insurance and Financial reserves
Visibility	Business intelligence; Information exchange; Tracking and tracing programs
Collaboration	Collaborative forecasting; Operational collaboration (Consignment Stock - CS, Vendor Managed Inventory -VMI, Resource Sharing and Dedicated Assets); Technological collaboration (Co-Design); Risk sharing with partners; Mutual knowledge creation
Risk Management Culture	Business continuity planning (BCP); Teamwork, Cross-training of workers; Responsibility, accountability & empowerment; Appropriate supplier selection & control; Learning, benchmarking and feedback

Sampling
We followed the procedure suggested by Voss et al., (2002) and Eisenhardt & Graebner (2007) for collecting cases among the supply chain. Besides, this work is based on the Italian Biomedical Industry which is specialised and leader in Europe in the production of disposable medical products, cardio surgery and dialysis equipment. Considering that the industry is confined to a small area in the north-east of Italy named Mirandola and Medolla, it is quite surprising how is capable of employing more than 3500 employees with about 300 companies active (Osservatorio Nazionale Distretti Italiani, 2014).
The choice of focusing the analysis in this specific industry was driven by peculiar internal and external characteristics that have made companies vulnerable to potential disruptions (e.g. highly regulated market due to patient's blood presence, products which high level of complexity and high-quality standard required and a small and limited supplier base). Moreover, last but not least, the area of Mirandola and Medolla was hit by two earthquakes and one flood in 2012 that have undermined the survival of companies. Research boundaries have been established within the work for controlling the complexity of the phenomenon under investigation. Three supply chain stages (focal companies, 1st tier suppliers and 2nd tier suppliers), as depicted in Figure II, have been considered in the analysis aiming to recognise patterns and relationships between variables (Voss et al., 2002; Eisenhardt & Graebner, 2007; Yin, 2013). As the main objective is to investigate resilience from a real supply chain perspective, three supply chain stages helped us in controlling the length and complexity of the chain and, at the same time, to move from the buyer-supplier perspective toward a better proxy

of the supply chain (Bhakoo & Choi, 2013). Besides, for ensuring that all cases belong to the same supply chain, we targeted a specific area of specialisation, which is the dialysis and companies specialised in the production of a specific product named filter for dialysis procedures. In this way, we were able to rebuild the supply chains involved in the analysis ensuring that companies belong to specific chains.

Data Collection and Data Analysis

Data was collected by means of semi-structured interviews according to an interview protocol specifically designed for capturing relevant insights needed for answering the research questions. First, we contacted the focal companies, and once they were willing to participate in the project, the interview was carried out. Besides, at the end of each interview with the focal companies, they provided a list of their suppliers. In this way, we were able to shape the supply chain up to the second-tier suppliers. Once again, targeting a specific product ensured that all companies proposed belonged to the same supply chain.

The protocol was crafted according to the supply chain stage in which the company operates.

The interviews have been conducted from February 2017 to July 2017 via telephone by two researchers with the top managers (e.g. supply chain managers, CEO). The interviews performed had a duration between 60 and 120 minutes. Furthermore, as suggested by Yin (2013), we collected information from web sites, industry and official reports for ensuring triangulation of data and achieving reliability. Besides, in case the information collected during the interview was not clear, we proceeded with a second contact by e-mail or telephone for ensuring data validity.

The final sample entails ten companies in three tiers within the supply chain as shown in Table II (data concerning companies' turnover and the number of employees refer to 2015).

Findings

Data have been analysed in the following way. First, we conducted a within case analyses. Then, we moved to a cross-case analysis per stage in which we focused on companies belonging to the same supply chain stage and finally, we performed a cross-stage analysis for identifying the resilience approach applied for dealing with the disruption (pre, during and post the earthquakes) in the three supply chain stages identified.

Resilience approach changes due to the disruption event

The first research question aims to identify how companies approach resilience for facing the disruptive events by focusing on the three phases: before being disrupted, during the disruption and after that. Resilience practices were tabulated according to the Table I. Specifically, we identified which practices were adopted and at which moment. Table III shows the cross-stage results in which we differentiated the resilience practices (and the relative capabilities to which they belong to) adopted in the three phases according to the supply chain stages targeted, where the X represents the number of occurrences of a specific practice (e.g. three X means that three companies at that supply chain stage applied that practice). We chose to report single case answers only in the second-tier suppliers stage. Findings show how resilience practices differ across the supply chain stages even though some of them are shared among them. Besides, we found how some practices were designed in advance for dealing with the disruptive events (e.g. Business Continuity Plan). While others practices have been added to the portfolio of resilience practices after being hit by the events. Indeed, results suggest how the resilient approach changed in the face of the disruptions occurred. To this extent, different practices were reinforced (e.g. having multiple suppliers) or even designed for the first time as a consequence of the disruption events outcomes. Focusing on providing a bigger picture of how resilience is achieved within the supply chains, we will describe what companies did proactively before

being disrupted and how the supply chain improved its resilience as a consequence of the deep awareness of the importance of improving the ability to mitigate such events driven by the earthquakes. As findings suggest, some practices have a supply chain nature while others are more focused on the company level. For instance, we noticed a strong level of collaboration among different entities in the supply chain. Both operational collaboration and technological collaboration was found.

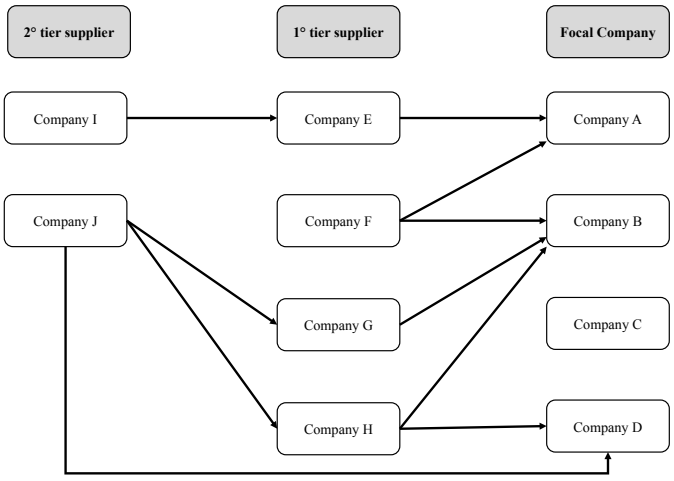

Figure II - Companies distribution across supply chain stages

To this extent, collaboration seems to be a requirement of the industry as it was originally fostered as a tool for achieving greater performance and foster innovation rather than improving resilience, as Company A stated, "*with a selected pool of suppliers (we) engaged in actual innovation projects, integrating them within our development procedure*". Despite this, the strong level of collaborative activities helped the supply chain in facing the events by increasing resources and information shared across supply chain members. Instead, other practices deployed fostered resilience at the company level. To this extent, we noticed how focal companies had already a BCP that helped in guiding the companies during the crisis. Moreover, companies defined safety stock in case of needed, and they validated alternative suppliers as back-up. Besides, we found out how companies emphasised the relevance of selecting suppliers taking into account risk and resilience considerations. Meaning, by evaluating and choosing suppliers according to their ability to face problems. Improving redundancy and risk management culture have proven to be essential for increasing resilience not just at the company level but rather to share the importance of having resources and keep in mind how problems can affect seriously operations across supply chain stages, as the disruptive events showed in 2012.

Finally, we focused our attention on how such disruptive events changed the resilience approach of companies in different stages of the supply chain. Indeed, findings confirm how the earthquakes brought relevant changes in the resilience practices.

An increased focus on flexibility was found. Indeed, all supply chain stages noticed how being flexible would have helped them in quickly adapt to deviations in the business environment. Besides, we noticed how focal companies and second tier suppliers decided to design products differently for increasing input commonality that can guarantee continuity in supplying. Furthermore, both focal companies and second tier suppliers sought to enlarge their supplier base in order to have at least a second supplier for each component (when it is possible).

The events themselves changed the sensibility towards disruptions completely. To this extent, Company A stated: "*after recovering from the event, we decided to include additional risk*

sources in our risk register". Indeed, companies fostered the risk management culture through the importance of team working and feedback strategies for reflecting and learn from what happened in the past. Aligned with the idea of creating a risk management culture, findings suggested how focal companies reinforced their business continuity plan. This advanced strategy for dealing with disruptions was already deployed by focal companies before the events in 2012, but it was felt more as a theoretical exercise rather than the first step towards an effective, resilient strategy. During the earthquakes, companies experienced the importance of having a plan for dealing with such a crisis and this helped in improving resilience proactively.

Table II - General information of the sample

Case	Industry Sub-sector/Product	Supply Chain Stage	Revenue (million €)	Number of Employees
A	Products for dialysis, enteral, parenteral nutrition, infusion and extracorporeal blood treatment.	Focal Company	61	213
B	Artificial kidneys; dialyzers; haemodialysis solutions; blood lines and dialysis filters	Focal Company	32	323
C	Filters for leucocyte removal from blood components	Focal Company	28	173
D	Dialysis equipment and disposables devices	Focal Company	232	906
E	Design of disposable devices, production and assembly of electro-medical devices	1st tier supplier	4	20
F	Dialysis line products and components, including tubes, junctions, blood lines.	1st tier supplier	40	46
G	Customized medical products for intensive care, haemodialysis and hemofiltration	1st tier supplier	2	23
H	Products for dialysis systems (dialyzers, filters, blood lines) and electro-medical equipment	1st tier supplier	25	50
I	Design and R&D of highly detailed stamps.	2nd tier supplier	8	40
J	Third party assembler of biomedical devices and bags for parental and enteral nutrition	2nd tier supplier	5	69

For instance, Company B stated "*since the disruption changed our life; we decided to create a crisis unit which is constituted by almost 40 people, in order to start working on business continuity*" while "*following the events we understood that we had to better organize our strategy by adopting a contingency plan*" was said by Company A. The following table (Table IV) summarises the improvement in resilience in the three stages brought by the events. Specifically, we put emphasises on the main investments done in practices.

Relational aspects of supply chain stages

Findings, at this stage, provide a step forward in defining how resilience is dynamically influenced among stages in the supply chain. We noticed both how decisions took in one stage of the chain creates effects downstream in the supply chain and how others stage in the supply chain proactively deployed strategies for helping customers/suppliers in dealing with problems. Results suggest how the focal companies had the power to lead the organisational changes in the resilience approach and such organisational changes drive resilience in the adjacent layers. So, in order to provide evidence on the supply chain nature of the resilience concept, we targeted two supply chains as the unit of analysis, engaging companies operating as first and second tier suppliers. Doing so, we were able to analyse how modified strategies outlined at the focal companies' stage drove an improvement in resilience in the overall supply chain.

Indeed, focal companies challenged their suppliers due to their reinforced engagement in practices for improving the risk management culture, such as BCP, appropriate supplier selection and control, team working and benchmarking. The improved awareness of the focal companies of the importance of having a supply base resilient, coupled with the strong collaboration that characterised the industry, forced suppliers to review their approach towards resilience.

For instance, it was clear how a higher flexibility was needed. Thus, focal companies demanded contractual modification for embracing a new attention to flexibility. Thus, one supplier during the event was able to provide production capacity. Besides, this was coupled with a demand of redundancy from the focal companies. Indeed, they learned how the first-tier suppliers could act as an important buffer. Furthermore, the importance of improving visibility between business partners was highlighted by the focal companies. Indeed, visibility was demanding by focal companies regarding operational activities (e.g. forecasting, process design, quality tests) and second tier suppliers' validation for improving the relationships between companies within the supply chain. Besides, practices like information sharing were crucial for understanding the current damages during the disruption and guarantee transparency in the supply chain. From a supply chain perspective, the requirements coming from the focal companies generated a domino effect upstream. Specifically, the first-tier suppliers engaged their suppliers in improving the information sharing among them, in order to provide a higher visibility at the focal companies' level as well. Besides, they asked for a greater degree of redundancy needed to guarantee a continuous availability of resources. To cope with these requirements, second tier suppliers improved safety stocks and started scanning possible new suppliers. Besides, they redesigned their operations in order to guarantee the possibility of having an extra production capacity to be dedicated in case of problems. Figure III shows the relational perspective of resilience across the stages. Specifically, highlights how resilience capabilities were modified within the supply chains, generating effects at the supply chain level (upstream and downstream). To this regard, the black arrows emphasise the overall improvement in resilience at the supply chain level due to the modification of resilient capabilities between stages while the coloured arrows describe the resilience capabilities modification driven by one supply chain stage on another.

The figure helps in shedding light on the supply chain nature of resilience. Indeed, results suggest how focal companies had the responsibility to drive a better risk attention within the supply chain. This responsibility had the consequence of improving the resilience of the whole supply chain by acting in each stage of the chain.

Discussion

This work is one of the first that investigates resilience from a broader perspective by disentangling a real supply chain.

Findings have proven how resilience is shaped differently within the supply chain. Companies operating at different tiers tend to manage risk by implementing practices that not always are aligned among partners. Focusing on what companies did proactively for facing disruptions, few practices were deployed specifically designed to create resilience (e.g. business continuity planning, multiple suppliers). Moreover, companies seemed to operate as silos without having in mind a real supply chain strategy. Despite this, companies have proven to be able to manage problems that in turn, fostered resilience within the all supply chain. Instead, after being affected by the earthquakes, companies developed a deeper understanding of the importance of being able to manage such events through a coordinated approach. Specifically, we noticed how such experience brought focal companies to push resilience within the all supply chain. Indeed, they focused their attention in modifying the internal capabilities needed for creating resilience and what is more important, they fostered a risk management culture upstream in the chain.

Table III - Cross stages analysis of the resilient practices deployed

		Focal Companies			1° tier suppliers			2° tier suppliers		
Capability	**Practices**	**Pre**	**During**	**Post**	**Pre**	**During**	**Post**	**Pre**	**During**	**Post**
Flexibility	Postponement									
	Modularity and interchangeability							X	X	X
	Process Redesign									
	Supplier contract flexibility			XXX			XXX			XX
	Product differentiation									
	Input commonality			XX				X	X	X
	Portfolio diversification				XX		XX	XX		XX
Redundancy	Reserve Capacity (Safety Stock, Multiple Sourcing, Extra-production	XX	XX	XXX	XX	XX	XXX	X	X	XX
	Financial reserves									
	Distributed Capacity & Assets				X	XXX	XXX	X	X	X
	Insurance	XXX	XXXX	XXX				X	X	XX
Visibility	Business intelligence									
	Information Exchange	XXX	XXXX	XXX	XXX	XXXX	XXX			XX
	Product/part tracking and tracing programs	XXX	XXXX	XXX						
Collaboration	Collaborative forecasting									
	Operational Collaboration (CS, VMI, Resource Sharing and Dedicate	XXX	XXXX	XXX	XXX	XXXX	XXX	XX	XX	XX
	Technological Collaboration (Co-Design)	XXX	XXXX	XXX	XXX	XXX	XXX	X	X	X
	Risk sharing with partners									
	Mutual knowledge creation							X	X	X
Risk Management Culture	Business continuity planning (BCP)	XXX	XXX	XXX						
	Teamwork, Cross-train workers			XX						
	Responsibility, accountability & empowerment									
	Appropriate Supplier Selection & Control	XXX		XXX	XXX		XXX	X		X
	Learning, Benchmarking and Feedback			XX						

Table IV - Summary of the resilience practices adopted after the disruption

Focal Company	First Tier	Second Tier
• Focus on Flexibility (e.g. multiple suppliers, suppliers contract flexibility); • Strengthen of the adoption of Business Continuity Plans (BCP) in order to increase the Risk Management Culture; • Increased requirements demanded upstream in the supply chain into contractual terms. Focus on flexibility and redundancy (e.g. safety stock, extra production capacity) of suppliers.	• Focus on improving their production capacity and the suppliers base; • Reinforced the collaborative approach both concerning operational and technological collaboration; • Enhanced the practice of information sharing for improving Visibility • Worked internally to increased awareness of the Risk Management Culture	• Fostered the level of Redundancy and Flexibility for improving reaction capacity within the supply chain; • Improved the role of Collaboration with downstream stages and Risk Management initiatives; • Embraced deeper level of information sharing for improving the overall Visibility in the chain

Due to the strong collaboration level of the industry, coupled with the bargaining power and the primary role in driving innovation, focal companies took the responsibility in driving a reshaping of the resilient approach. This is in line with the RDT's concepts, in which larger companies, as the focal companies considered in this work are, play a central role in reducing uncertainties by setting up guidelines for their suppliers, or by sharing information of the importance to gain resilience. To this extent, they acted in improving the idea that resilience is achieved by investing in practices that are applied in a day-to-day context. Thus, practices that were already applied frequently, like information sharing, supplier evaluation, multiple sourcing, could have assumed a different connotation under the umbrella of resilience. As they started to be applied having in mind a double goal: improving performance under stable conditions and, on the other side, mitigating problems under disruption occurrence.

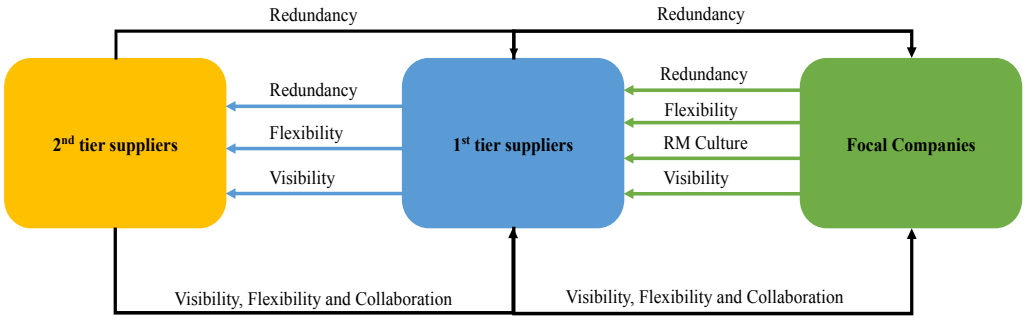

Figure III - Relational perspective of resilience capabilities within the supply chain

Doing a step forward, findings suggest how the behaviour of the focal companies in demanding more robust strategies with their suppliers, lead to dynamic improvements in the whole supply chain. Hence, focal companies understood how improving the resilient approach upstream, in turn, would have enabled them to increase their resilience as well. Going upstream in the supply chain, members recognised the importance of adapting their resilient strategies for complying on what focal companies demanded. An explanation can be provided using the Resource Dependence Theory. Indeed, from the RDT point of view, focal companies exploit their leading role in the collaborative relationship as the first tier and second tier suppliers are not able to

increase power in the relationships even though they play a crucial role in the production of the final products. It is worthwhile highlighting how resilience is influenced dynamically within the supply chain as the resilient strategy applied in one stage of the chain lead to consequences elsewhere. For instance, focal companies started including redundancy requirements in legal term with their suppliers. Thus, from a supply chain perspective, this leads to a cascade effect upstream because first and second tiers suppliers had to improve their redundancy capabilities. Hence, companies must rely on each other if they want to have a real resilient supply chain. In fact, RDT proposes how supply chain partners depend on each other for providing resources that are essential for creating resilience as even suggested by Ponomarov, (2012). Furthermore, according to the RDT principles, the collaborative nature of the Italian Biomedical industry can be used as a further element for explaining how resilience is achieved within the tiers. Indeed, companies aim at gaining beneficial outcomes in their business activities through collaboration, but such level of collaborative practices can foster a greater level of resilience as well by improving the effort developed during the crisis (e.g. prompt communication between companies, awareness of the current level of stock, production capacity).

Conclusion

Supply chain resilience aims in improving the ability of the supply chain to deal with problems. During the last years, academics and practitioners have engaged with the concept, but the full theoretical knowledge of how resilience is enhanced within the supply chain is far from being achieved (Tukamuhabwa et al., 2015; Hohenstein et al., 2015). This work has a twofold goal. First, we aimed to provide insights on how supply chain resilience is affected by disruptions. To this regard, we applied the Critical Incident Technique (CIT) to target a specific disruption that affected the Italian Biomedical Industry in 2012. Thus, we were able to understand what companies did before being disrupted, during the disruptions and what changes brought the event. Secondly, we decided to push forward the idea of how resilience is dynamically shaped within the supply chain. To this extent, we aimed to understand how resilience is influenced by choices adopted by supply chain actors elsewhere within the chain.

Implications for theory

This work leads to significant theoretical contributions. As far as our knowledge, few works have analysed supply chain resilience beyond the dyad relationships. Doing so, we provided clear evidence on how focal companies can drive the resilience of the whole supply chain. Indeed, after being affected by the earthquakes, focal companies understood the importance of increasing a risk management culture within the supply chain by coordinating resources, synchronizing efforts and demanding an increased deployment of resilience capabilities. Second, we noticed the importance of having visibility upstream in the supply chain, helped to reduce the ripple effect across tiers. Results are aligned with the contributions provided by Harland et al., (2003) and Brandon Jones et al., (2014), who highlighted how supply chain visibility affect resilience positively. Third, our findings showed how companies in different tiers of the supply chain contributed to resilience through a different portfolio of resilience capabilities. Specifically, focal companies achieved resilience by exploiting risk management culture (e.g. business continuity planning), visibility with upstream partners and by guiding the collaboration. Instead, first and second tiers suppliers contributed to resilience mainly through flexibility and redundancy. To this extent, we foster the idea how resilience can be achieved in the supply chain by deploying different resilience capabilities that might be not aligned within the supply chain. Specifically, focal companies achieved resilience by exploiting risk management culture (e.g. business continuity planning), visibility with upstream partners and by guiding the collaboration. Instead, first and second tiers suppliers contributed to resilience mainly through flexibility and redundancy. To this extent, we promote the idea of how

resilience can be achieved by deploying different capabilities that might be not aligned within the supply chain. Doing so, companies aim to improve their survivability ability by improving resilience at the supply chain level, as the ability to face disruptions requires to shift from a company perspective to a supply chain one (Rice & Hoppe, 2001). Fourth, this work is one of the first that shed light on the dynamic nature of resilience. Indeed, the interdependencies at the different levels of the supply chain (e.g. upstream and downstream) lead to variations on how resilience is achieved across stages. Last but not less important, this work contributes to the literature by applying the Resource Dependence Theory (RDT) (Pfeffer & Salancik, 1978) as the theoretical lens for understanding how the collaborative nature of the Biomedical industry foster resilience. According to RDT, companies implement a strong degree of collaboration for reducing uncertainty in the chain. To this extent, we showed how the focal companies, due to the power of such collaboration, inspired a better awareness of the importance of being able to handle problems within the chain through investments in resilience capabilities done by their suppliers.

Implications for practitioners

Managerial implications are provided as well. The primary managerial consideration is the supply chain nature of resilience that goes beyond the boundaries of the single company. Managers should work closely with their supply chain partners for understanding the improvement areas and how resilience can be fostered within their supply chain. Second, our findings suggested that resilience is achieved through practices applied in a day-to-day context, but such practices can be crucial for creating resilience during a crisis. For instance, practices like information sharing, multiple sourcing and supplier selection and control are applied on a daily basis for improving effectiveness and efficiency. To this extent, we provide evidence on how such practices are relevant for fostering supply chain resilience in both small and larger companies.

Future research

Future research is encouraged for deepening the supply chain nature of resilience. Specifically, we suggest to analysis the role of collaboration on resilience. Indeed, our work has proven how collaboration can help in dealing with disruption events as it was one of the key capability that helped companies to mitigate and recover from the disruption occurred. However, the nature of collaboration and the different degree through which collaboration is enabled were not part of the analysis, so we encourage scholars to provide further studies on it. Further supply chain stages or different products could be explored since the Italian Biomedical industry has shown a real network feature and the complexity of products are a potential driver toward an increased vulnerability. Besides, a contingent analysis should be carried out for understanding the role of variables such as firm size and product typology in the resilient approach of companies.

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Supplier base dynamics. A case study of a buying firm during five decades

Anna Dubois and Lars-Erik Gadde
Technology Management and Economics
Chalmers University of Technology
SE-412 96 Gothenburg, Sweden

Abstract
This paper reports a longitudinal study of the development of the supplier base of a firm between 1964 and 2015. The results show that the supplier base changes considerably over time, while few changes are observed from one year to the next. The changes are explained by factors related to purchasing policy, relationship effects and technical modifications. Conclusions regard supplier base dynamics, as well as some methodological implications.

Keywords: Purchasing, supplier relationships, supply base

Introduction

The relationships with business partners are claimed to be the most strategic assets of a firm (Ford et al., 2011). Several authors point out the significance of suppliers by acknowledging contributions related to innovation, manufacturing, logistics, and product development (e.g. Håkansson and Snehota, 1995; Liker and Choi, 2004; Johnsen 2009). Therefore, specific attention has been directed to the strategic impact of the whole constellation of the supplier network in which the buying firm resides (e.g. Bensaou, 1998; Dyer et al., 1998; Gadde and Håkansson, 2001; Holmen et al. 2007; Håkansson et al., 2009). Following Bygballe and Persson (2015), we discuss this constellation in terms of the supplier base of the buying firm.

A common conclusion in studies of business relationships is that potential benefits arise over time, implying that effective business relationships feature longevity. However, only seldom are such assertions supported by data confirming these conditions. One exception is Håkansson (1982) who provided information about the length of almost one thousand business relationships at one point in time. The dynamics of the relationships in the supplier base were studied by Sundhof and Pietsch (1964). However, the insights in the development of these business relationships are limited since the time series embraced no more than three years. Kamp (2005) investigated the features of the supplier bases of two US plants for car assembly, and the changes during seven and eleven years respectively. The two cases differed with regard to dynamics – one was characterized by change, the other by stability. Hence, more research is motivated to increase the understanding of the long-term development of the business relationships in buying firms' supplier bases.

This paper reports a study of the dynamics of a subset of the supplier base of a fork-lift manufacturer over more than half a century (1964 – 2015). This period spans almost the entire life of the company that was founded in 1958. The overall objective of the study is to identify, describe, and analyse the dynamics of the supplier base over time. Such longitudinal research has been recommended as an important complement to the more common cross-sectional studies (Buvik and Halskau, 2000; Pfeiffer, 2010).

Theoretical anchoring of the study

It is a common view that external partnerships are established in order to acquire critical resources (e.g. Pfeffer and Salancik, 1978; Håkansson and Snehota, 1995). From a resource orchestration perspective, Sirmon et al. (2011) concluded that the needs of a buying firm change over its life cycle. In the growth phase, ambitions to secure adequate production capacity are central, as well as developing skills for the further relationship-building with suppliers. In the mature phase, efforts to acquire and integrate various sources of knowledge into the firm's operations and resources become increasingly important in order to create capabilities that can contribute to improved performance. Other authors pointing out the significance of organizational life cycles in relation to purchasing and supply management are, for example, Fox and Rink, (1978), Jap and Anderson (2007), Vanpoucke et al. (2014).

The above conditions affect what supplier features are most useful for a buying firm in various situations and result in changes of business partners over time. In turn, these replacements of individual suppliers cause the dynamics in the supplier base. Understanding supplier base dynamics thus require understanding of supplier switching patterns. However, Bygballe (2017, p. 40) concluded that "supplier switching remains largely unexplored". Similar claims were made by Pfeiffer (2010) who found that research tends to present snapshots of these phenomena rather than capturing their dynamics. Moreover, Vanpoucke et al. (2014) argue that although it is widely accepted in the literature that relationships develop over time, most research only looks at a single point in time in a relationship. This conclusion is shared by Jap and Anderson (2007), which leads to our first research question: What characterizes the development of the supplier base with respect to continuity and change of individual supplier relationships?

Pick (2010) analysed the length of relationships and the reasons for supplier switching. She concluded that certain factors were related to suppliers in terms of their lacking commitment and the buyer's dissatisfaction with their performance. Other factors concerned the situations of buying firms with regard to changes in the supply they required. In both cases the existence and quality of alternative suppliers was a critical determinant, which was pointed out also by Gadde and Håkansson (2001). Ferguson and Johnston (2011) found that the relationship length and the number of suppliers varied among purchased items with regard to the type of purchase in terms of novelty, complexity and importance. Bygballe (2017) added the buyer's strive for independence and ambitions to reduce costs as potential reasons for switching suppliers. Cost reduction as a main reason for changing suppliers was pointed out also by Quayle (1998) and Wathne et al. (2001). Accordingly, the second research question of the study is formulated as: What are the reasons for switching suppliers?

Entrance of a new supplier is not necessarily accompanied by ending of the relationship with an existing supplier. Pick (2010) claimed that termination of a relationship can be complete or partial. Partial termination implies that the old supplier will be kept in a dual (or multiple) sourcing setting. Moreover, Friedl and Wagner (2012) argued that an alternative to switching supplier for reasons of dissatisfaction would be supplier development, echoing the categorization of Hirschman (1970): exit, voice and loyalty. Finally, a supplier once replaced by another one may come back later. According to Bygballe (2017, p. 42) few studies have addressed the "self-return process initiated by the customer". This conclusion was shared by Pick (2010) who asked for more research "on the duration of the second or third relationship with a former business partner". Thus, our third research question deals with two sub-issues related to termination of relationships:

- To what extent is supplier switching partial or complete?

- To what extent do suppliers in terminated relationships come back, and how long are they then able to remain in the supplier base?

In the third section of the paper below we present some details regarding the empirical study; what was covered and how data were collected. This is followed in section four by description and analysis of the changes in the supplier base in four time periods (RQ1). Section five provides an account of the reasons for supplier switching (RQ2), while the features of the supplier switching patterns (RQ3) are analysed in section six. This is followed by discussion of the results in section seven and concluding remarks.

About the study

The study reports the development of the supplier base of a fork-lift manufacturer between 1964 and 2015. Initially, the research project covered eleven components featuring variety in terms of economic importance, technical complexity, supplier markets and whether the component was customized or standardized. When the study began, these components accounted for about one third of the total purchasing costs of the buyer. This share has been reduced slightly over time owing to integration of additional technologies. The suppliers used by the buying firm for the eleven components are reported in Appendix 1, which shows that there are some missing data in the beginning. Moreover, three of the components are no longer purchased since they became part of a system, for which both component sourcing and assembly was outsourced. The components, their main features, the observation periods and the number of suppliers used for each component are shown in Table 1.

Component	*#*	*Product features*	*Economic importance*	*Number of years*	*Suppliers used*
Mast profiles	1	Customized	Medium	52	4
Small-sized engines	2	Standardized	Medium	52	3
Batteries	3	Standardized	High	52	6
Fork carriages	4	Customized	Medium	52	9
Large-sized engines	5	Customized	Medium	48	4
Needle bearings	6	Standardized	Low	52	5
Forged forks	7	Customized	Low	52	6
Castings	8	Customized	Low	40	5
Ball bearings	9	Standardized	Low	51	8
Cog-wheels	10	Customized	Low	40	8
Spiral cog-wheels	11	Standardized	Low	21	6

Table 1. Characteristics of the sample of components

Four phases featured by differences in sourcing patterns were identified. This diversity was best illustrated when the time series was divided into four phases of equal length (1964-1976; 1977-1989; 1990-2002; 2003-2015). In the following section we describe the developments of the supplier base in the four phases.

Supplier base development 1964-2015

Phase 1 – 1964-1976

In this establishment and expansion phase the features of the fork lift were in continuous development with frequent design changes. During the 1960s the supplier base was quite stable, while the first half of the 1970s featured considerable dynamics. There are several reasons for the stability in the first part of the period. The buying firm used the suppliers they

had identified and tried from the beginning. Owing to lacking knowledge of alternative suppliers, the buyer mainly stayed with these established sources. Moreover, because of the limited volumes required, the buyer was not recognized as an interesting business partner. Finally, by focussing on a limited number of suppliers, the buying firm could reduce the supplier handling costs. The number of suppliers for the eleven components was reduced from 15 initially to 11 in 1971. This year, all but one component was single sourced.

From 1970 these conditions began to change. The firm was expanding substantially with a yearly average growth rate of almost 50 percent during the coming fifteen years. Since many of the initial suppliers were small they were not able to keep up with this expansion. Therefore, additional suppliers were required to secure supply. In 1976 the number of suppliers had increased to 22 and for seven of the ten previously single-sourced components more than one supplier was now used. Two other factors contributed to the expansion of the supplier base. Firstly, although still a small buyer, the growing size of the firm enabled splitting of the purchasing volume on two suppliers to stimulate price competition. Secondly, some customers had their particular requirements regarding fork lift features to which the buyer had to adjust by using different sources. The supplier base grew partly from increasing knowledge of supplier markets and partly from returning to some suppliers that had been abandoned in the previous ambition of promoting single sourcing. One organizational modification affecting these conditions was the appointment of a new purchasing manager.

Phase 2 – 1977-1989

From the end of the 1970s the buyer started to consolidate the supplier base. The expansive phase with increasing numbers of suppliers can be seen as a test period. Some new suppliers lived up to the expectations and were able to secure an established position in the supplier base. Others failed in this respect owing to quality and/or delivery problems or unsatisfactory price levels. Ten of the seventeen suppliers that had been introduced in the middle of the 1970s were no longer used at the end of the 1980s. The majority of these changes concerned two components that accounted for limited economic importance, and supplier markets featuring price competition.

1988 was the last year when all eleven components were purchased. At that time the number of suppliers had been reduced to 16 to be compared with 22 in 1976. The number of single sourced components had been more than doubled – from three to seven. For the other four components the buyer used more than one supplier. The dual/multiple sourcing approaches were explained by quite different reasons. For one of the components the technology was changing and the current supplier was successively replaced by a new entrant. In another case the component had developed into two distinct types which were now delivered by two specialized suppliers. For the third component, two suppliers were used to secure the volumes required. Finally, the multiple sourcing applied for batteries was due to customer requirements for specific brands.

The overall consolidation of the supplier base was affected by three main factors. First, the previous expansion caused problems in handling the large supplier base. Second, the firm's growth began to make the buying firm an interesting customer, thus enabling the opportunity to settle favourable economic agreements. Third, a change from forecast planning to order-based control called for long term agreements and joint planning with suppliers.

Phase 3 – 1990-2002

In the beginning of this phase, the buying firm was inspired by general trends in purchasing management in terms of outsourcing and system sourcing. Influenced by such thoughts the buyer began considering sourcing of systems rather than components. These plans required time to materialize, but successively affected the component structure of this study. One reason for the interest in system sourcing was that at the end of the previous phase, customer adaptations had become increasingly important. This approach required modular product design, which called for enhanced cooperation between purchasing, production and design. The change to modular designs increased the number of variants substantially. To handle these conditions, product development became increasingly driven by cost reduction ambitions. The opportunities residing in such efforts are illustrated by the fact that changing from four to three variants of one type of fork-lift reduced costs with about 15 percent.

At the end of phase 3, the size of the supplier base was almost the same as at the end of the previous phase – 15 suppliers were used in 2002 for 10 components to be compared with 16 when 11 components were purchased. Despite these seemingly stable conditions, several changes were observed. For four of the single sourced components in the beginning of phase 3, the previous suppliers were substituted by other single sources. In one case, the supplier no longer manufactured the component. Another supplier had problems with its own suppliers which caused substantial problems for the buying firm that had to find a new business partner. For one of the standardized components, price reductions were obtained by switching to a new suppler. Finally, for the fourth component, several reasons explain the change. The supplier in the beginning of the period caused lots of problems for the buyer with regard to quality and delivery. Furthermore, the price level of this foreign supplier became unfavourable owing to changing currency rates. Finally, the new supplier was able to provide specialized components to support the variety required by the vehicle manufacturer.

Regarding two previously dual-sourced components, one became subject to single sourcing, while in the other case the two suppliers used in the beginning of the period were replaced by two others. Regarding batteries, two suppliers were added because of customer requirements.

Phase 4 – 2003-2015

A major change in this phase was that the buying firm in 2007 was acquired by a Japanese Automotive Group (henceforth referred to as JAG). The ownership connection to this corporate group enabled increasing economies of scale through realization of potential synergies. However, the various business units within JAG are free to select the suppliers they prefer; there is no centralised decision-making in this respect. What is offered by JAG is a common strategic perspective and some tools for supply analysis, such as item categorization related to the Kraljic matrix. These changes have made it more difficult for a supplier to enter since potential partners are evaluated and tested more thoroughly than before. In the beginning of this period, the purchasing manager appointed in the middle of the 1970s resigned. The new manager was then substituted in 2010, and at the end of this study also this one had been replaced.

In this final phase, components 8 and 10 had become part of a system and were no longer purchased. At the end of the period the remaining eight components were supplied by 11 suppliers, compared with 14 in the beginning of the period. This change involved a reduction of the suppliers of batteries from five to two, which is explained by modifications in the

supplier market in terms of mergers and acquisitions. Three of the components (1, 2, 9) were supplied in exactly the same way during the entire period. For three of the single sourced components in the beginning of the period (5, 6, 7) the suppliers were substituted by other single sources. Regarding component 5 the supplier used in 2003 had entered the supplier base in 1999 because of technical modifications – the previous source had not been able to adjust to this change. In turn, this new supplier lost its position in a second shift of technology in 2008 and was replaced by a supplier used for another component. The change of supplier for component 6 is again explained by price conditions and implied a come-back of the supplier that had been replaced in the previous phase. In the last year of the observation period, the relationship with the supplier of component 7 was terminated. This change was due to coordinated decision-making within the JAG Group. Finally, the remaining component (4) was dual sourced in 2002 and remained so in 2015. However, the two suppliers used in 2002 were replaced by two others for several years, but at the end of the period one of the former ones re-entered.

In phase 4, the previous focus on reducing the number of product variants was modified. Instead, increasing variety was motivated by enhanced orientation in relation to the diverse requirements of customers. Moreover, in the beginning of the fourth phase, sourcing from low-cost countries was at the top of the purchasing management agenda in general. For the focal firm of this study, however, this approach did not turn out as favourable owing to long lead times featuring this supply alternative.

Relationship dynamics

Table 2 illustrates the variety in the relationship dynamics by describing the length of the relationships with the 64 suppliers used during the 52 years. One supplier has been used each year, and three others have supplied for more than forty years. Three of these four were still used in 2015, which illustrates the longevity of some buyer-supplier relationships. On the other hand, some relationships are quite short-term. 24 suppliers (38%) have been used less than five years. The average duration of the supplier relationships amounts to 12.5 years.

Number of years as supplier	1-4	5-9	-14	-19	-24	-29	-34	-39	-44	-49	-52
Frequency of suppliers	24	11	8	5	6	3	3	0	1	2	1
Suppliers remaining in 2015	1	1	1		4		1		1	1	1

Table 2. Duration of the supplier relationships

The main finding of the study is the confirmation of the short-term stability of supplier relationships. Many researchers have claimed that this stability exists, but limited empirical support has been provided. To investigate these conditions in the current study the changes from one year to the next were analyzed. The total number of decisions regarding supplier selection was 501 (52 years for eleven components, minus missing data). Each decision represented a potential change in terms of entering and/or terminating relationships with suppliers. The analysis revealed that 416 (83%) of these decisions implied that the same supplier(s) was used from one year to the next. The buying firm thus made changes of the supplier base at 85 occasions during the period between 1964 and 2015. The proportion of years without changes in the supplier base increased over time from 74% in the first phase, via 82% in the second and 88% in the third to 91% in the final phase. These figures can be compared with findings in a Japanese study containing information about business exchange among 500.000 firms during five years. The results showed that the proportion of the

relationships that continued from one year to the next amounted to 92 percent on average (Mizuno et al., 2014).

In a longer time perspective, however, the supplier base changed considerably. Of the fifteen initial suppliers, eight remained at the end of the second phase. Four of these relationships were terminated during the third phase, and at the end of the fourth phase only one of the original suppliers was still used. In the above discussion we argued that phases one and three featured substantial dynamics while the second and the fourth were characterized by striving for stabilization. This claim is supported by the fact that the number of new suppliers introduced in the four phases amounted to: 26, 7, 12 and 4, respectively.

Changes of the supplier base and drivers of change

We reported above that the total number of changes from one year to the next amounted to 85. These changes demonstrate no clear differentiation between the frequency of changes for standardized and customized components, which was somewhat surprising. Four of the components together accounted for half the number of changes, two of which were standardized and two customized. Another interesting finding was that one of the standardized components accounted for the least frequent changes (5%).

The drivers behind the 85 changes in the supplier base were discussed in the interviews with informants. Although some changes resulted from the combined effects of several factors we classified each change as a consequence of the most important factor. The analysis showed that the changes could be explained by the impact of eight main factors, six of which matched the ones identified in the literature review. In the analysis we grouped the eight factors into three categories. Two of them represent changes of purchasing policy and relationship effects, which include the six factors from the literature review. The third group, involving technical modifications, represent new factors identified in the study.

The impact of purchasing policy

The single most important driver of dynamics was the ambition to reduce cost – accounting for more than one third of the total changes (35%). Cost was the most important factor behind supplier replacements for seven of the components – three of which were standardized and four customized. Also for the four other components the buying firm strived to reduce cost, but in these cases other factors were more important. The results indicate that price reduction is less important for items that are economically significant. Three standardized components together represent one third of the changes related to cost reduction. In these cases switching costs were low in the absence of adaptations. These conditions make it easy for new suppliers to enter. At the same time, however, they are easily replaced, indicated by the fact that many of the suppliers that entered on a low-price basis were used only a few years.

‘Avoiding dependence’ and ‘consolidation of purchases’ were the main reasons for almost ten percent each of the changes. Avoiding dependence on specific suppliers is often used as a means to stimulate price competition. Sometimes, suppliers were added to reduce the perceived dependency related to transaction uncertainty in single sourcing settings. However, these attempts were not very successful owing to suppliers’ performance failures, and some of these relationships were terminated quite soon. ‘Consolidation of purchases’ has become increasingly applied in the fourth phase after JAG’s acquisition of the buying firm. The

underlying motivation regarding benefits from this approach is related to increasing volumes in relation to individual suppliers and thus reduction of administrative costs.

Relationship effects

Problem with supplier performance was the second most important driver of changes, representing 17 percent of the total changes. All these modifications of the supplier base related to six of the components – all of them customized. A plausible interpretation of this finding is that inadequate performance of a supplier delivering an important customer specific solution leads to termination of the relationship. However, termination of the relationships was not always the outcome. In some situations, quality and delivery problems were solved jointly with the suppliers, rather than by replacing the business partner. Furthermore, the buyer used some suppliers for a long time despite dissatisfaction with their performance. Since the firm is relatively small in relation to most of its suppliers there were problems in engaging large and powerful suppliers in activities aiming at adaptations and customization.

Customer requirements have driven changes with substantial consequences for the supplier base. Foreign sales subsidiaries tend to request local components in some cases, especially for batteries. Such demands are expressed as reflecting the perceptions and preferences of fork-lift users. For this reason the buyer relied on 3-5 suppliers of batteries between 1971 and 2009. This approach led to considerable costs for handling and administration of both suppliers and transactions. Moreover, the buying power of the vehicle manufacturer was reduced which impacted negatively on price negotiations.

Almost ten percent of the changes originated from suppliers. In two cases the relationships ended because of bankruptcy of the business partner. Moreover, two suppliers shifted the production of the components to other firms belonging to the same corporate groups, which did not work out well for the buyer. One supplier of a customised product closed down the production of this component. The supplier perceived the volume demanded by the vehicle manufacturer to be too marginal and decided to concentrate on other products and customers. Furthermore, a global supplier delivered a low volume component used by a diminishing range of customers. To enable elimination of this component the supplier doubled the price. Since the component was standardised, other suppliers were available for the buying firm.

The impact of technical modifications

Technical changes related to design and manufacturing was the third most important of the drivers, representing ten percent of the total changes. Design modifications impact on production technologies and may call for replacement of suppliers. Four customized components have been affected by such technical adjustments. Changes from one technology to another typically require that the prevailing and the new technology are used in parallel for some time. Therefore, technical modification processes normally cover a couple of years.

The second driver related to technical modifications regards the launch of new models and product variants, which sometimes require changes in the supplier base. Such changes are reported for two customized components. However, many of the technical challenges were handled in ongoing supplier relationships. For example, one of the customized components was affected by two major technical changes. In the early 1980s the manufacturing operations of the buyer demanded a change from extrusion to rolling, a requirement the existing supplier was unable to handle. The new supplier of rolled materials was added as a complement to the

supplier of extruded materials for two years. Then the relationship with the first supplier was terminated and the new one was still used in 2015. The second change was conducted in the 1990s within the relationship to the supplier of rolling materials and regarded modifications of production technologies to reduce costs for the substantial range of product variants. Through the joint activities of the two parties some production steps could be eliminated and some activities were outsourced to the supplier.

Supplier switching patterns

The third research question dealing with supplier switching patterns involves two issues. The first regards the situation when new suppliers enter and established suppliers lose positions. Entrance of a new supplier may occur through direct substitution in relation to an existing one. In this case the old relationship is terminated. In other cases the new supplier is added as a complement to the current one. The old supplier is then kept but has obviously lost position. This change is classified as partial switching from the previous supplier's point of view. Finally, complete switching occurs when a supplier relationship is terminated without entrance of a new one. This is the situation when one relationship is terminated in dual or multiple sourcing arrangements. Table 3 illustrates the frequency of these supplier switching patterns in the 85 changes of the supplier base.

Switching pattern	*Number and percent*	
Direct substitution of supplier. Old relationship terminated.	39	46%
Complete switching. Existing relationship terminated. No new supplier.	23	27%
Partial switching. New supplier in – the old supplier continues	23	27%

Table 3. Frequency of supplier switching patterns

The second sub-issue regarded to what extent suppliers in terminated relationships are able to re-enter the supplier base. As shown in Table 3, the total number of terminated relationships amounted to 62 (39+23). 14 of these suppliers managed to come back after the relationship was terminated. This means that 23 percent of these suppliers re-entered the supplier base. 11 of them re-entered once, while two came back twice. One of the suppliers of a standardized component featuring substantial price competition re-entered no less than four times.

Table 4 presents the details of the 14 re-entering suppliers regarding the years they supplied the buying firm and the years they were not supplying. These figures provide also information regarding how long time the suppliers remained in the supplier base after re-entrance.

Supplier	1	2	3	4	5	6	7	8	9	10	11	12	13	14
# of supply years - first entry	10	10	5	9	5	15	1	1	7	7	3	3	1	13
# of years with no supply	17	3	6	2	12	7	5	4	2	2	3	2	5	8
Supply years at second entry	*13*	*1*	5	*11*	*7*	4	22	1	1	1	2	2	3	*8*
# of years with no supply											2	3	2	
Supply years at third entry											4	1	13	
# of years with no supply											1			
Supply years at fourth entry											2			
# of years with no supply											2			
Supply years at fifth entry											2			

Table 4. Fourteen suppliers that re-entered after termination of the relationship (Italics indicate that this supplier was still used in 2015)

Four of the suppliers had delivered for more than ten years when the relationship was terminated for the first time, while seven of them had been involved five years or less as suppliers. Eight of the fourteen suppliers then re-entered within five years. Two suppliers had to wait longer for their comeback – 12 and 17 years respectively. In most cases, the re-entering suppliers did not stay long – nine of them were dropped again after five years or less. On the other hand, three relationships continued for more than ten years and two of them were still ongoing in 2015. One of the suppliers (13) entered a third time and managed to keep the position in the supplier base for thirteen years. Suppliers 11 and 12 represent the most frequent changes. Both suppliers deliver standardized components where a multitude of alternatives are available, thus making switching less complicated.

Discussion

In this section we discuss the results from the study with regard to the supplier base dynamics, the variety of the features of the business relationships, and the interplay between change and continuity.

Supplier base dynamics

The study revealed substantial dynamics of the supplier base over time. Clear differences were observed in the four phases with regard to purchasing behavior and supply chain management. These finding support the argument in previous research that purchasing behaviour changes across the various phases of corporate life cycles. For example, Fox and Rink (1978) pointed out the problems that may occur in the growth phase when the initial suppliers may lack capacity to supply the buying firm. Adding supplementary suppliers is a means of handling these conditions but leads to increasing relationship costs. In this situation, the tendency is similar to what was found in this study, that "procurement shifts to suppliers with large capacity" and that buying firms consider the "feasibility of long terms contracts with fewer sources" (Fox and Rink, 1978, p. 190).

In previous research there is an ongoing debate whether life-cycle dynamics follow a linear or a cyclical pattern (Vanpoucke et al., 2014). Our study supports the argument of Ring and van de Ven (1994) that the dynamics tend to be cyclical. There was no steady trend in the increases, decreases, and other changes of the supplier base. Instead there were movements back and forth, depending on various conditions. Some of these changes were generated from the inside of the buying firm while others were initiated by the business partners. The most significant driver of change was internal: ambitions to reduce cost, which is well in line with findings in previous research (e.g. Quayle, 1998; Wathne et al. 2001). The second most important driver concerned poor supplier performance, which is supported by Keaveney (1995) who found that service failure was the most frequent reason to switch to new suppliers. In some cases, suppliers initiated termination of the relationship since they decided to prioritize other customers, an approach identified also in Gadde and Håkansson (2001). Finally, the significance of technical factors for changes in the supplier base have been observed in several other studies (e.g. Dubois and Araujo, 2006).

Another external impact on sourcing behavior and the supplier base was related to the general development within the practice of purchasing and supply chain management. During the

fifty years, this field has undergone major changes (e.g. Trent and Monczka, 1998; Araujo et al., 2016). Some of these changes were clearly observable in the case study, such as outsourcing, system buying and increasing involvement with some suppliers. Most of these modifications originated in the vehicle industry and affected many of the suppliers of the fork-lift manufacturer, and thus impacted both directly and indirectly on the buying firm in this study.

The variety in the supplier base

There was considerable diversity with regard to the length of the relationships in the supplier base. The study confirms common claims regarding the existence of long-term relationships. The longevity is explained by various causes identified also in other studies. One reason stems from adaptations in relation to suppliers (Gadde and Håkansson, 2001) and the switching costs associated with these investments (e.g. Wathne et al. 2001). Moreover, by staying with the same supplier, buying firms can reduce the costs related to finding a new source, identified also by Zajac and Olsen (1993). Finally, in some situations it might be difficult to find alternative suppliers. Similarly, Jarvis and Wilcox (1977) concluded that repetitive purchasing behavior sometimes originated in perceived absence of other suppliers.

Another feature of variety regards the economic importance of the various suppliers. One source of variety is caused by the respective components they supply. Furthermore, there is substantial variety with regard to the dependence to the various suppliers since the level of involvement differs. Exploiting and maintaining such diversity in the supplier base has been recommended as a means of developing effective approaches to purchasing and supply management (Bensaou, 1999). Moreover, there is considerable diversity between the suppliers of the same component. For dual-sourced components, one of the suppliers is normally the main source, accounting for the larger share of the total volume.

Some features of the supplier relationships were not in accordance with contemporary perspectives of effective purchasing. For example, the buying firm applied single sourcing in supplier markets where many alternative suppliers were available and no relation-specific adaptations were required. In these situations, mainstream literature at the time recommended buyers to rely on multiple sourcing to stimulate competition between suppliers. However, later on the approach applied by the buying firm was legitimized by Quayle (1998) who advocated single sourcing even in a buyer's market, since switching to another supplier would be easy in case of supplier failure. Moreover, some of the long-term relationships were not very close in relational terms, which also contrasted prevailing assumptions in the literature. However, over time 'this durable arm's-length' approach was identified as a useful means of routinizing operations (Dyer et al, 1998; Gadde and Håkansson, 2001; Jap and Anderson, 2007).

An interesting observation was that the buying firm continued to buy from some suppliers although they were frustrated with regard to their performance. Similar conditions were identified by Backhaus and Buschken (1999), Jap and Anderson (2007), as well as by Håkansson et al. (2009) who claimed that buying firms in some situations tend to use suppliers they neither like, nor trust, simply because they represent the best offerings.

Change and continuity – an interesting interplay

The dynamics of the supplier base have been analyzed in terms of the frequency of relationship changes from one year to the next. This approach offers a simplistic perspective on the actual supplier base dynamics. As exemplified above, some of the supply problems were handled within the ongoing relationships. Even if these relationships continued, the modifications undertaken also represent dynamics, since changes were made with regard to, for example, component design, planning and delivery conditions, as well as the level of interaction between buyer and supplier.

There is also another change in the supplier base that passes unnoticed with the approach applied in this study. In cases of dual or multiple sourcing, the buying firm sometimes shifted the suppliers' share of the total purchases in order to stimulate competition or express disappointment with supplier performance. This approach has also been used in the phasing-out and phasing-in of suppliers in accordance with what Pick (2010) identified as partial switching. Such changes are also aspects of supplier base dynamics since they impact on the strength and position of the various suppliers. Finally, over a long time period the relative importance of the components changes, for example through increasing significance of electronics. When some components become more important, the suppliers of these components improve their relative positions in the supplier base.

Concluding discussion

The main contribution of the study is the detailed examination of the long-term development of a subset of the supplier base of a company. The description and analysis, related to the first research question, provides knowledge regarding the longevity and dynamics of buyer-supplier relationships. Our findings are based on systematic observations over fifty years resulting in a unique data-set, while previous research often tends to be based on what McMillan and Farmer (1979) characterized as anecdotal data or biased samples involving the most important suppliers. As indicated by Table 2, many relationships are quite short-term, which might support the argument of McMillan and Farmer (1979).

In response to the second research question, the changes from year to year were explained by the impact of purchasing policy, the effects of relationships with customers and suppliers, and the role of technical modifications. Finally, the supplier switching patterns related to the third research question contribute knowledge that other researchers have called for.

In this final section we reflect on the impact of time in longitudinal studies like this one. There are certain implications of time for both research methodology and theoretical framing. Based on our findings in this study, we agree with Pettigrew (1990, p. 1) in his argument that "time sets a frame of reference for what changes can be seen and how these changes are explained".

Regarding methodological implications, the differences between the dynamics in the four phases indicate the importance of timing. It would be unusual for a 'normal' study to cover even one of these phases. The impact of time can be exemplified with two results from this research. First, a study covering phase 1 only, would most likely conclude that the supplier base for two of the components (9 and 10) features substantial change since no less than fifteen suppliers were used in this phase. Someone studying only phase 3 would arrive at another conclusion since for the same components only three suppliers were used. Similarly, a study of component 4 in phases 1 and 2 would characterize the supply of this component to feature strong continuity – only two suppliers were used for the 25 years between 1964 and

1989. During the following 22 years, however, eight suppliers were used. Therefore, we find it reasonable to believe that the differences in terms of supplier stability and change in the two cases studied by Kamp (2005) can be explained partly by the time factor.

In relation to the theoretical context, this study was initiated at a time when research on buyer-supplier relationships was in its infancy. Over time, we have learnt a lot about buyer-supplier interaction and the content of business relationships, as well as their connectedness. In today's research landscape, the importance of understanding how individual relationships are embedded in networks of other relationships have become central in inter-organisational research. Therefore, in view of the current theoretical context, the data based on the dyadic and buyer-oriented perspective applied in the study is somewhat problematic today. First, the study does not include the suppliers' perspectives on the relationships and their interpretations of the reasons for the changes. Second, the study does not capture the whole supply base of the company, but rather an arbitrary sub-set of its supplier relationships. Third, the interaction between the buyer and its suppliers has not been captured in the study. The latter is particularly problematic since what has been interpreted as 'continuity' may indeed contain a lot of interesting changes regarding the content of the relationships.

Hence, the longitudinal approach has revealed some interesting and important findings regarding the dynamics of the supplier base and supplier switching, as well as some of the main reasons for these changes. However, more complete understanding of these phenomena requires further studies. Such studies should also take the supplier perspective into consideration, as well as both firms' interpretation of their interaction. They also need to go deeper into the analysis of the processes underlying the situations we have classified as change and continuity. The understanding of these processes requires a network perspective since what can be achieved in the relationship between a buyer and a supplier is dependent on their relationships with other business partners.

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Appendix 1

Year	Components										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1964	A	A	AB	A	n.a	AB	A	A	n.a	AB	n.a.
1965	A	A	AB	A	n.a	AB	A	A	A	AB	n.a.
1966	A	A	AB	A	n.a	AB	A	A	A	AB	n.a.
1967	A	A	AB	A	n.a	AB	A	A	A	AB	n.a.
1968	A	A	AB	A	AB	AC	AB	B	A	AB	A
1969	A	A	AB	A	A	C	B	B	B	ABC	A
1970	A	A	AB	A	A	C	C	B	C	ABC	A
1971	A	A	ABC	A	A	C	C	B	C	D	B
1972	A	A	ABC	A	A	C	CD	B	CD	D	C
1973	AB	A	ABC	A	A	C	CD	B	CDE	AB	C
1974	AB	A	ABC	A	AB	C	CD	B	BCDFG	EFG	A
1975	AB	A	ABC	AB	AB	AC	D	B	CDFH	EFG	AD
1976	A	AB	ABC	AB	AB	AC	D	BC	DFH	EFG	E
1977	A	AB	ABC	AB	A	AC	D	B	DFH	EH	E
1978	A	AB	ABC	AB	A	AC	D	B	DFH	H	AE
1979	A	AB	ABC	AB	B	AC	D	B	DEF	H	A
1980	A	AB	ABC	AB	B	C	D	B	DE	H	A
1981	A	AB	ABC	AB	B	C	D	B	DE	H	AE
1982	AC	AB	ABC	AB	B	C	D	BD	DE	H	E
1983	AD	AB	ABC	AB	B	C	D	BD	DE	H	A
1984	AD	AB	ABC	AB	B	C	D	BD	DE	H	A
1985	D	AB	ABC	AB	B	C	D	BD	DE	H	F
1986	D	A	ABC	AB	B	C	D	BD	DE	H	E
1987	D	A	ABC	AB	BC	C	C	BD	DE	H	A
1988	D	A	ABC	AB	BC	C	C	B	DE	H	A
1989	D	A	ABCD	AB	BC	C	C	B	DE	H	
1990	D	A	ABCD	ACDE	BC	C	C	B	DE	H	
1991	D	A	ABCD	ACDE	BC	C	C	B	DE	H	
1992	D	A	ABCD	ACDE	C	C	C	B	DE	H	
1993	D	A	ABCD	ACDE	C	C	C	B	DE	H	
1994	D	A	ABCD	ACD	C	D	D	B	DE	H	
1995	D	C	ABCD	ACD	C	D	D	B	DE	H	
1996	D	C	ABCD	ACD	C	D	D	B	DE	H	
1997	D	C	ABCD	CDF	C	D	D	E	DE	H	
1998	D	C	ABCD	CDF	C	D	E	E	DE	H	
1999	D	C	ABCD	CDF	CD	D	E	E	DE	H	
2000	D	C	ABCD	CF	D	D	E	E	DE	H	
2001	D	C	ABCE	CF	D	D	E	E	D	H	
2002	D	C	ABCEF	FG	D	D	E	E	D	H	
2003	D	BC	ABCEF	FG	D	E	E	E	D	H	
2004	D	BC	ABCE?	FG	D	E	E		D		
2005	D	BC	ABCE	FG	D	D	E		D		
2006	D	BC	ABCE	FG	D	D	E		D		
2007	D	BC	ABCE	FG	D	D	E		D		
2008	D	BC	ABCE	FG	C	D	E		D		
2009	D	BC	ABCE	FGH	C	D	E		D		
2010	D	BC	AC	FGH	C	D	E		D		
2011	D	BC	AC	GHI	C	D	E		D		
2012	D	BC	AC	HI	C	D	E		D		
2013	D	BC	AC	HI	C	D	E		D		
2014	D	BC	AC	HI	C	D	E		D		
2015	D	BC	AC	GI	C	D	F		D		

A (or AB) represents the initial suppliers for each component.
Added suppliers are labelled B, C, D, etc. as they enter the supplier base.

Malicious Supply Chain Risk: A Literature Review and Future Directions

ABSTRACT

Supply chain risk management faces a myriad of challenges. Perhaps the most understudied of which deals with intentional disruptions; that is, those disruptions arising from deliberate actions that can negatively affect supply chain operations and performance. This paper focuses on suppliers intentionally undermining the operations of a supply chain through opportunistic behavior such as: deception, product fraud and contract/trust breeches. Such behavior engenders relational failure and leads to a type of risk that extant models of risk management have neglected. Accordingly, proactively managing this type of risk requires a substantially different management approach. The following presents a review of the innovative work in this domain and subsequently advances a framework for aiding managerial decision making for proactively managing and coping with such intentional risk in a supply chain. This framework encapsulates a three-pronged approach centered on avoiding & detecting, mitigating the impact of and recovering from this unique type of supply chain risk.

INTRODUCTION

Supply chain risk, as an academic body of work, has explored much in terms of how to effectively manage risks which are from inadvertent causes such as weather-based disruptions or accidental supply failures through a variety of process-focused research. However, much opportunity remains to explore the role of relational risk associated with other companies or individuals in the supply chain engaging in malicious behaviors that can lead to disruptions. We introduce the term malicious risks to discuss these types of risk which are relatively unexplored including opportunism, supply chain fraud, counterfeit manufacturing, digital security threats, IP theft, etc.

Managing supply chain risk is an important component of supply chain management. Risks can vary from major disruptions due to natural disasters, supplier bankruptcy, quality failures, fraud, etc. In order for firms to develop a resilient supply chain, it is important that they are able to correctly interpret supply chain risk and adapt operations to meet those risks (Ambulkar, Blackhurst, & Grawe, 2015; Pettit et al., 2016). With that in mind, it is important that researchers recognize a type of risk which has received limited attention in the literature, which we identify as malicious supply chain risk. We define malicious supply chain risk as the risk a firm has as a result of an individual or organization making a deliberate decision that can lead to harmful outcomes on the firm and its extended supply chain.

LITERATURE REVIEW

We note that this area of research on risks associated with malicious behavior is increasing over the past years. The evidence suggests that companies are increasingly facing crises from product harm that results in a product recall (Liu, Shankar, & Yun, 2017). Despite these increases, there is limited research which explores the motivation to engage in fraudulent actions at an organizational level (Arnold, Neubauer, & Schoenherr, 2012).

Recent research has explored aspects of disruption risk related to intentional behavior in some way, including threats from theft, piracy, terrorism, contamination, counterfeiting and product tampering. (McGreevy & Harrop, 2015), preparing a supply chain for premeditated attacks on facilities (Parajuli, Kuzgunkaya, & Vidyarthi, 2017), how to monitor fraud risks in the supply chain. (Vollmer, 2015), or issues related from profiting from product-harm crises in competitive markets (Rubel, 2018), among others. While much of the research in this area explores specific threats/risks, there is some research which suggests strategies for managing these types of risk. DuHadway, Carnovale, and Hazen (2017) explore key differences in how to

manage intentional disruptions (similar to the concept of malicious risks used in this paper) as opposed to traditional disruptions, suggesting that mitigating intentional disruptions requires relationship based approaches, while recovering from disruptions requires the ability to restructure a supply chain. Other research suggests that manufacturers must build forms of relational governance to safeguard against the relational risk of partners (Cheng & Chen, 2016).

Research which identifies the antecedents of similar disruptions or opportunistic events have found that power asymmetry/imbalance, culture can lead to malicious risks (Villena & Craighead, 2016; Madichie & Yamoah, 2017).

Perhaps the most closely connected literature stream to malicious risks is that which explores opportunism, or 'self-interest seeking with guile' (Williamson, 1985). Using opportunism as a basis, we can identify many different types of behaviors which fit with malicious risk that have seen some exposure in the literature.

EXAMPLES OF MALICIOUS RISKS

Consider two major automotive recalls of Takata airbags and the Volkswagen emissions scandal. The Takata airbag recall, which was the largest automotive recall in history occurred because Takata switched their production to using ammonium nitrate instead of tetrazole in their airbag design to cut costs and then lied to their customers regarding the safety of the new compound being used. Takata "routinely manipulated results of air-bag inflator tests" (Trudell & Fisk, 2016). Data indicating the risk of the airbags was deleted and customers were unaware of the risks that Takata knew and understood. Takata engaged in malicious behavior to advance their own interests at the expense of their supply chain partners.

Volkswagen engaged in deceptive practices which ultimately led to a recall for their vehicles which used software to deliberately cheat emissions testing, causing an estimated 59 premature deaths (Barrett et al., 2015), and a financial settlement of over $15 billion in the United States (Fisk et al., 2016). Interestingly, in both of these cases safeguards were in place (air-bag inflator tests to verify safety and emissions testing procedures) were in place to prevent problematic behavior, yet the firms intentionally circumvented such process controls and engaged in malicious behavior for their own self-interest.

In 2013, it was found that beef lasagna contained horsemeat of varying percentages, but with some of them containing 100% horsemeat (Brown, 2013). It is absurd to think that the introduction of horsemeat into the beef supply chain occurred through some inadvertent or accidental measure given that we normally learn the skill to differentiate between a horse and cow as a toddler. At some point in the supply chain, someone made the decision to substitute a horse for a cow and sell it as beef and did so intentionally, likely because it saved them money. Even though beef and horsemeat might be reasonably comparable, the act of deception in the supply chain is what serves to motivate the exploration into malicious risks. If our supplier says, "This is beef" – should we not be able to rely on that statement? And if we do decide that we aren't ready to trust our supplier, how can we protect ourselves from when suppliers decide to deliberately deceive us, or when our suppliers themselves have been duped? The issue of product deception and fraud very quickly becomes a supply chain issue, because the ramifications of deceptive behavior have very far reaching effects on all members in the supply chain.

There are examples of firms who have taken the appropriate quality control measures to protect their supply chain who have been impacted by deliberate deception of a supplier. The lead-based paint toy recalls from 2007 which Mattel experienced are notable because Mattel

established and paid for a testing facility to test often take what would normally be appropriate measure to ensure that the materials coming into the supplier's facility were of appropriate quality. However, their supplier intentionally went around the testing facility (Woo, 2008). Accordingly, we need to rethink the way we manage a supply chain to limit our exposure to malicious risks. Traditional process-based approaches can be ignored or circumvented.

Malicious risks can take a variety of different forms, including falsifying data, supply chain fraud, counterfeit manufacturing, digital security threats, intellectual property theft, contract breach, etc. A 2012 study found that 33% of the 1215 fish samples collected at restaurants, sushi vendors, and grocery stores were labeled incorrectly (Warner et al., 2013). Supply chain fraud has been identified as the "single most exposed area" of fraud (Bhide, 2012, p. 16). Counterfeit Manufacturing has become a large problem in the automotive supply chain, and examples of their impact on manufacturers and consumers are not difficult to find. Daimler seized 1.6 million counterfeit products in a single year (Daimler, 2017). Mislabelled counterfeit plastic parts in Aston Martin vehicles have led to major recalls (Wowak & Boone, 2015; DuHadway, Carnovale, & Hazen, 2017).

If we are relying on process based controls, we are inherently relying on trust as a protection mechanism to ensure that such procedures are followed. While trust can be good, consider the dark side of trust as well.

To highlight this dark side of trust, consider the example provided in the book *Turtles of the World* (Bonin, Devaux, & Dupré, 2006). The authors explore a number of different species of tortoises, finding that in some species an interesting symbiotic relationship emerges between the turtles and some local finches. The finches eat the small bugs and parasites that live on the turtles, particularly in hard to reach places such as under the head and neck of the turtle. This

behavior involves a turtle signaling to the bird by raising up on its front legs and letting the bird crawl underneath him to eat the insects. However, some of the turtles have tasted the dark side and learned that by suddenly dropping itself onto the bird, it can catch the bird under its shell, crushing it and providing a good source of nourishment in the form of newly tenderized protein. Although this example is quite extreme, trust in relationships is exhibited in similar ways. It slowly develops over time as expected behaviors emerge which can form mutually beneficial relationships. Yet if one party decides to start playing unfairly, it can have dramatic consequences on the other involved parties.

MANAGING MALICIOUS RISKS

We explore three traditional approaches for managing risk which include detection/avoidance, mitigation, and recovery. These three phases of risk management represent before, during, and after a disruptive event has occurred.

Detection can serve as an early warning system, or can help to dodge a disruption completely. If the disruption is unavoidable, it can ensure that good plans are in place to manage the disruption once it occurs. For example, the price of bitcoin has been very volatile.. This has led to shortages of video cards and incredibly high prices, as one of the ways that bitcoins can be gathered is through electronic mining which is most efficient using high-end graphics cards. However, due to the fluctuation of prices of bitcoins, the demand is highly uncertain and difficult to predict. Being able to observe early market trends can help firms avoid under-producing or over-producing products leading to either a disruption, or a surplus of product that needs to be liquidated at a lower price.

A number of detection and avoidance mechanisms exist, including quality management (Lee & Whang, 2005), information sharing (Sheffi, 2001; Kleindorfer & Saad, 2005), supplier

audits and supplier development (Giunipero & Aly Eltantawy, 2004), and security assessment and management practices (Finch, 2004) among others. Even though there are many different mechanisms for detection, effective detection which comes from information sharing, supply chain visibility, and supplier integration can detect or prevent a variety of disruptions (DuHadway, Carnovale, & Hazen, 2017).

Mitigation can limit the potential impact of a disruption occurring. This is critical for minimizing the harm to a supply chain from a disruption. Some research suggests that structural approaches can help to mitigate damage, such as modularity and diversification (Kleindorfer & Saad, 2005). Other more traditional approaches might include inventory (Chopra & Sodhi, 2004; Tomlin, 2006). These strategies are important to recognize, because it is possible that these strategies exacerbate the risks of malicious disruptions rather than limiting them. For example, consider the impact of high levels of inventory when the disruption is due to supply chain fraud such as lead-based paint in children's toys. Higher levels of inventory would then need to be discarded in addition to the carrying costs of maintaining higher levels of inventory. Modularity has been argued to generally limit exposure to opportunism (Lippman & Rumelt, 1982; Pil & Cohen, 2006), but if the modular system is compromised through intellectual property theft or counterfeiting, the issue could be further exacerbated because the entire system is now compromised.

Recovery is another aspect of risk management that requires a completely different approach. One of the most common approaches for risk recovery is to develop a resilient supply chain, or one that is quickly able to return to it's previous state after a disruption (Christopher & Lee, 2004). However, this approach is counter-intuitive when the disruption is caused by malicious risk. When the disruption is caused by malicious risk (such finding out that your supplier has

been selling you a counterfeit product) there is no value in returning to the previous state, so resilience based recovery approaches are insufficient. Using an analogy of a human immune system, we can liken resilience to being able to recover from injury (generally an external cause, sharp/immediate pain, which heals over time). However, disruptions from malicious risks would be more likened to that of an infectious disease (occurs from inside, the spread/impact is not immediately visible, and can significantly worsen if not treated in some way). This requires a different strategy to resolve, focusing generally on internal treatment. In extreme situations, the appropriate strategy for managing an infection might be to cut out the infected part. The approach that should be taken when a supplier has a product quality failure due to some accidental cause should be substantially different than when a supplier intentionally deceives or lies about product quality and intentionally substitutes an inferior product to make money.

DRIVERS OF MALICIOUS RISKS

Although research on malicious risks is relatively limited, we identify three areas which can provide potentially interesting directions for future research. These include: structural causes, network exposure, and behavioral drivers.

- ***Structural causes*** for malicious risk can include risks associated with the general trends in with regards to the changing environmental conditions surrounding supply chain management in a modern era. These include the increasing reliance on digital manufacturing, high levels of modularity, data security processes, the world becoming increasingly connected, emergent cultural differences through a more connected world, etc.
- ***Network exposure*** can explore how the different network structures that firms find themselves in can change their exposure to malicious risks. For example, highly central

firms or firms with a high degree of connectivity to various firms might experience more exposure to malicious behavior. In addition, the influence of opportunistic behavior on a network could exhibit transitive properties such that malicious risks can spread throughout a network. The increasing role of Internet of Things and the connectivity across many different systems can also have implications on malicious risks.

- Lastly, ***behavioral drivers*** can lead to malicious behaviors. Dependence asymmetry, trust and relational governance, transitive trust, cultural norms and values, business ethics, etc. can provide interesting insight in terms of how can we limit malicious supply chain risks.

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Governance Mechanisms in Multi-tier Sustainable Supply Chains

Yasmine El-Henawy
The German University in Cairo
Email: Yasmine.elhenawy@gmail.com

Dr. Sherwat Elwan
The American University in Cairo
Email: sherwat@aucegypt.edu

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Critical factors have been identified in the literature affecting sustainability of multi-tier suppliers. This study aims to explore the use of different governance mechanisms to influence the environmental sustainability compliance of suppliers and multi-tier suppliers. Mediating and non-mediating power will be investigated in a global supply chain setting.

Keywords: Environmental sustainability; Multi-tier suppliers; Governance Mechanisms

Introduction

Organizations nowadays exert so much time, efforts resources in developing, sustaining and enhancing their supply chain relationships as such relationships have clear outcomes in terms of operational and financial performance. According to literature there are two main types of governance in buyer supplier relationships formal and informal governance. Formal governance, focuses mainly on the importance of mediating power use and explicit contracts between firms to prevent any opportunism and conflicts. On the other hand, the informal governance highlights the non-mediating power use to avoid potential risks accompanied with uncertainty and transaction-specific investments (Noordewier et al., 1990; Uzzi, 1997) and coordinate buyer supplier relationships (Dyer and Singh, 1998; Heide and John, 1992; Macneil, 1980)

As firms can use both formal and informal governance to manage their relationships with their suppliers, the relation between formal and informal governance in buyer supplier relationship has been an important study topic in operations and supply chain management (Lumineau and Henderson, 2012) it's a subject of matter also in other areas such as marketing (Cannon et al., 2000; Yang et al., 2012), strategy (Li et al., 2010a; Poppo and Zenger, 2002), entrepreneurship (Chen et al., 2013; Strätling et al., 2012), and international business (Zhou and Xu, 2012) for more than a decade.

Poppo and Zenger (2002), were the first to shed the light on this particular issue, since then it has gained increasing attention. However, knowledge on the relation between formal and informal and their applicability in the buyer supplier relationship specifically in the multi-tier environmen-

tal sustainable supply chain governance has not been discussed. (Puranam and Vanneste, 2009; Schepker et al., 2014). Current literature is mainly divided into two groups. One group claims that the two types of governance substitute each other; which means the use of one type of governance decreases the benefits of using the other one (Huber et al., 2013; Li et al., 2010c; Lui and Ngo, 2004). There is a claim by some authors that Formal governance may hinder the existence of the informal one, as it's unusual to find buyers or suppliers eager to go for long-term collaborative relationships (Cox et al., 2003; Ramsay, 1996; Sanderson, 2008).

On the other hand, another group argued that the two types of governance may be complementing each other's which means that the use of one strengthen the use of the other one (Liu et al., 2009; Poppo and Zenger, 2002). A clarification of the way in which these governance mechanisms work best to affect environmental sustainability or even influencing suppliers applicability to certain activities will definitely guide practitioners to decide their suitable way to govern the relationship with their partners whether it is formal, informal or both. In particular, investigation of the possible moderating effects on the formal-informal governance interaction may inform managerial practice by highlighting significant contextual factors.

Therefore, to choose the suitable governance mechanisms to influence a firm's multi-tier suppliers' applicability of environmental sustainability, a focal firm needs to periodically assess its interdependence and power position relative to their suppliers and customers (Dyer & Singh, 1998; Lazzarini, Claro, & Mesquita, 2008; Poppo & Zenger, 2002). It was argued that organizations need to have a positive evaluation of their partner's performance in order to justify involvement in collaborative initiatives (Wang, Kayande, and Jap, 2010). Meaning that, there has to be some performance advantages in order for organizations to be involved in the potentially risky and time-intensive collaboration (Johnson et al., 1993).

Buyer supplier governance and sustainability

As previously mentioned governance is the relations through which partners in buyer supplier relationship create, sustain, and reshape network activities (Raynolds, 2004). Consequently governance mechanisms refer to any type of practices used by firms to handle relationships with their suppliers for the sake of enhancing their performance in general. Yet in this paper we will be focusing on enhancing multi-tier supplier's environmental sustainability. As the increasing expectations of corporate conduct in line with the ever-growing enlargement of global supply chains, Firms have to respond by integrating environmental concerns into their supply chain agendas.

As the competition increases the pressure to minimize costs has motivated suppliers, especially those of the less developed countries, to break the sustainability standards in order to avoid costly changes and loss of competitiveness, leading to lower quality and sustainability violation, in addition to losing partners and stakeholders' trust and opportunities for long- term value creation. Thus the focal firm has to consider the whole supply chain sustainability as focusing only on the direct supplier's sustainable performance definitely is not enough. There are lots of efforts that has to be conducted by every firm to encourage their multi-tier suppliers as well to comply with sustainability standards. (Lim and Phillips, 2008; Maloni and Brown, 2006).

Past literature on governance mechanisms to influence sustainability of multi-tier suppliers reveals that some studies have concentrated on how much suppliers abide by codes of conduct and assessment (e.g., Krueger 2008; Mueller et al. 2009; Preuss 2009; Van Tulder et al. 2009; Yu 2008); other papers have reevaluated the key assessment and market governance mechanisms in the light of proposals for long term collaboration (e.g., Lim and Phillips 2008; Park-Poaps and Rees 2010; Spence and Bourlakis 2009; Vachon and Klassen 2006; Vurro et al. 2009), and a few made a comparison among the influence of different mechanisms (e.g., Keating et al. 2008; Jiang 2009a, b; Klassen and Vachon 2003; Lee and Klassen 2008; Reuter et al. 2010; Large and Gimenez Thomsen 2011).

It has been also noticeable that among these past studies, certain papers have studied the effects of these mechanisms from the buying firm's point of view (e.g., Keating et al. 2008; Large and Gimenez Thomsen 2011; Lee and Klassen 2008; Reuter et al. 2010), while others have analyzed them from the perspective of the supplier (e.g., Jiang 2009a, b; Klassen and Vachon 2003). So basically, papers that study the governance of sustainable processes throughout the whole supply chain agree that the better sustainable performance a firm achieve the better ability to build and sustain integrated techniques toward supply chain management, based on long-term cooperation, shared knowledge, and joint development of competence both upstream and downstream (Maignan et al., 2002; Shepherd and Gunter, 2005; Strand, 2009). Nevertheless, there is still a difference between firms in terms of both the extent of these collaborative techniques along the supply chain and to which degree sustainability issues are addressed to the advantage of all partners involved (Jiang, 2009; Perez-Aleman and Sandi- lands, 2008; Roberts, 2003).

Formal governance and environmental sustainability

Formal governance in buyer supplier relationship context indicates the extent to which the supply chain is governed by explicit rules, procedures, and norms that authorize the rights and duties of the individual firms that establish it (Choi & Hong, 2002). Other definition to formal governance mechanisms is the structural arrangements formed to control the behavior of supply chain partners in an explicit way (Blome, Schoenherr & Kaesser, 2013; Huang, Cheng & Tseng, 2014). They consist of command structures, incentive systems, standard operating procedures, and documented dispute resolution procedures (Alvarez et al., 2010), and often depend on hierarchical controls (Gulati & Singh, 1998).

There is an obvious increase in interest showed by consumers and NGOs in adherence to environmental sustainability standards, which can barely be captured in the product itself but have become a critical matter of contractual commitments owed by the supplier to the buyer. As these contracts are clearly stating expected roles, responsibilities, processes, and output standards (Huang et al., 2014). Particularly, formal governance of environmental management activities may be recognized through environmental standards, audit procedures, codes of conduct, formalized processes, or a list of restricted materials (Miemczyk, Johnsen & Macquet, 2012; Pilbeam, Alvarez & Wilson, 2012). Even though they are mainly monitoring activities, they may also involve some collaborative activities, for instance, a supplier visit followed by an action plan.

Formalization works better to enhance supplier's environmental performance in the case of high uncertainty (Alvarez et al., 2010) because some suppliers may commit unethical or illegal actions that consequently oblige the focal firm to use costly monitoring techniques (Simpson and Power 2005; Carter and Rogers 2008). Uncertainties about the assessment of environmental performance and the critical points among the many lower tier suppliers can become barriers environmental sustainability implementation. Taking Nike as an example on this issue, the firm set environmental performance baselines and sustainability improvement targets for Asian suppliers via a formal environmental management initiative (Plambeck, Lee & Yatsko,2012), Wal-Mart as well followed a formal assessment approach globally with a 15-question survey to allocate business and choose suppliers to engage at a more strategic level based on their environmental performance (Plambeck & Denend, 2011).

If buyers and suppliers follow the same rules and procedures, eventually the transaction costs will reduce and information flows will be more efficient (Choi, Doolety & Rungtusanatham, 2001). Moreover, formal governance tends to reduce coordination needs, especially when it comes to higher technological components, anticipated coordination costs or interdependence (Gulati & Singh, 1998). This sort of relationship usually acts as a form of normative pressure in the buyer supplier relationship (Di Maggio & Powell, 1983). These pressures exist when there is a strong desire to professionalize organizational practices and enhance environmental performance through mechanisms such as industry standards. Getting back to the Wal-Mart example, formal chain-of-custody certification systems are enabling Wal-Mart to map its supply network and make the supply network practices more visible, allowing for redesigning the network with the goal of cutting environmental footprints (Plambeck, 2012).

Yet, formal governance mechanisms have some disadvantages. Designing, implementing, and imposing formal control criterion waste important organizational resources (Schmoltzi & Wallenburg, 2012). In other words, if there is a high level of formal control this will imply that there are high ex-ante contractual costs and ex-postmonitoring and enforcement costs (Huang et al., 2014). In addition to all of these costs, still using formal governance excessively will not prevent opportunistic behavior and will definitely have negative influence on buyer–supplier cooperation (Huang et al., 2014). What is make the situation worse is the existence of the commoditization of auditing systems and widespread corruption will by default make the violations of environmental standards tolerable (Lee et al., 2012). Consequently, suppliers may learn to cover up all their environmental violations by associating with indigenous consulting services (Plambeck et al., 2012). Therefore, informal, trust-based governance mechanisms (e.g., information sharing, values, culture, and norms) are essential in such cases.

Informal and environmental sustainability

As mention in the previous section, formal contracts will often be incomplete and have some critical drawbacks (Williamson, 1981) and accordingly require informal mechanisms to minimize ex-posttransaction costs of monitoring and coordination (Kale & Singh, 2007) as it involves the idea of collaborative planning and solution finding among firms. Informal governance mecha-

nisms could be presented in many forms such as peer-to-peer learning, noncompetitive supplier working groups, NGO partnerships, interactive websites, supplier/industry forums, incentives to self-reporting, and informal supervision through environmental databases (Plambeck et al., 2012). Informal governance has gained attention recently for many reasons. First, increasing transparency and inspection from NGOs make social control easier rather than bureaucratic system (Lee et al., 2012). Therefore informal governance is the best substitute to the formal one, when monitoring and formal controls are difficult and costly (McEvily, Perrone & Zaheer, 2003).

Back to Nike again, the company trains its suppliers to supervise their own suppliers using NGO guidelines. It encourages the culture of self-reporting, creating reward plans for suppliers who detect any sustainability violations and come up with solutions instead of just punishing any noncompliance (Lee et al., 2012). This is considered to be another sort of informal governance which is called "self-regulation" that depends mainly on the moral perspectives (Schmoltzi & Wallenburg, 2012). To encourage suppliers to apply the idea of self-regulation some industry initiatives such as the Leather Working Group are industry forums that give suppliers the opportunity to share their environmental practices (Lee et al., 2012).

Not only Nike but also Wal-Mart uses to reward its noncompetitive supplier working groups in collaboration with NGOs to motivate suppliers' green innovation (Plambeck & Denend, 2011). This strengthen the idea that non-mediated power are creating ties between organizations can serve as social mechanisms of control (Jones et al., 1997). In these cases, rather than applying a court-enforced contract, firms may involve relational governance (Baker, Gibbons & Murphy, 2002).

Before going into more details on the informal or collaborative approach we should explain the in between type of environmental governance which is environmental monitoring. If we classified buyer supplier governance into two mechanisms, environmental monitoring is considered to be in the gray area between both mechanisms. Monitoring may be required by the supplier himself to enhance his compliance of code of practice or public standard. Even more, these standards are included in the assessment criterion of suppliers (Walton et al., 1998). The most common international standard nowadays is ISO 14001 certification which is a voluntary standard that companies can certify in order to undertake its framework, rather than establishing environmental performance requirements.

Yet, each focal firm has the freedom to choose the suitable environmental procedure that can be imposed on suppliers. Therefore, as the customer requires certain quality specifications for parts and components, as certification of suppliers' environment management systems become yet another condition. Otherwise, environmental performance standards can be directly required mentioned previously. Taking a simple example of suppliers who are forced to follow strict environmental standards is the commercial printer who supplies packages to an environmentally-conscious consumer-product producer, such as The Body Shop, can be obliged to stick to a minimum level of recycled fibers in the paperboard supplied by the paper mill.

On the other hand, for the focal firm to monitor environmental collaboration it has to devote certain resources to develop cooperative practices to integrate environmental issues in the supply chain (internalization dimension). These practices tend to capture the added value that can be resulted from a collaborative buyer-supplier relationship to minimize the environmental footprints as much as possible. For instance, in chemical management services, a supplier of chemicals is helping his customers in their own facilities to minimize their use of chemicals. Moving from environmental monitoring to environmental collaboration which is totally opposite as it doesn't focus on the direct outcome of the suppliers' environmental efforts (e.g. compliance to existing regulations); instead it focuses on the process used by these suppliers to achieve more environmentally-sound operations or product.

This sort of relationship helps to develop trust and a better understanding of buyers expectations, especially when it comes to non-economic elements of performance that eventually improve environmental sustainability. Stating it differently, when there is a high level of uncertainty, trust is essential, and this trust will not exist if there is not a sort of informal interactions between partners (Galaskiewicz, 2011). Back to environmental collaboration, the sharing of tacit knowledge is definitely a critical factor to strengthen the technological integration (Grant, 1996). Thus, this technological integration within a supply chain is expected to have a positive impact on cooperative activities associated with environmental issues.
Beside the technological integration there are also two important characteristics of the supply chain structure which have a significant effect on the environmental cooperative activities. The size of the supply network, both upstream and downstream, as it potentially influences the importance of the formal governance and willingness to collaborate (Geffen and Rothenberg, 2000; Krut and Karasin, 1999). For suppliers, extensive environmental monitoring aims to ensure conformance with government regulations and establishing systems to minimize uncertainty related to environmental issues (Min and Galle, 2001). This uncertainty is not just legal or financial, but also operational. For example if a supplier is obliged to terminate his business because of an illegal material use or because it faces a regulatory liability to clean up contaminated soil, the focal firm might suffer from an immediate shortage of a critical part or material.

On the other hand, environmentally-conscious customers might decide to boycott the company's products or services because of supplier-based environmental violations (most probably supported by non-government organizations (NGOs)). Furthermore, the firms which depend mainly on a large supplier base are more likely to have one or more suppliers who violate environmental regulations (e.g. emissions standards). Therefore, firms can reduce risks or respond promptly to environmental issues through greater monitoring of both suppliers and their sub-suppliers. In contrast, there are firms which are mainly relying on a small number of suppliers. The parties are more likely to move from pure transaction-based to more relational interactions. A high level of trust permits management to reduce their scarce resources consumption on environmental monitoring (with relatively little value added) and focus on other more critical aspects instead, such as improvement.

Otherwise, concentration can raise the probability of disruption risk; therefore it requires an increased monitoring of suppliers. Moreover, the costs of monitoring are expected to be reducing in the case of a small supply base, also encouraging more active monitoring. While the benefits of supplier base reduction is still debatable from an organization' perspective (Cousins, 1999), it can be argued, that a larger supplier base makes it harder to develop long-term relationships and integration (Trent and Monczka, 1999). The reduced likelihood of a long-term relationship is likely to hinder the initiation of environmental collaboration. Likewise, a firm that has multiple customers will not likely invest in environmental activities with specific customers – except they account for a large fraction of revenue or can be transferred to most customers (vachon2006)

Multi-tier suppliers' governance and environmental sustainability

The most critical environmental issues in the supply chain are mainly created by suppliers located in the second tier or further upstream, which also referred to as multi-tier suppliers, or sub-suppliers. There is an estimation that up to 90 per cent of greenhouse gases emissions could be generated by lower-tier suppliers. This makes us doubt the actual impact of "low emission" objectives and other sustainability initiatives taken recently by many firms. However, multi-tier suppliers have some characteristics that make it complicated for focal firms to govern their sustainability. First, focal firms cannot easily have a full knowledge and information about their multi-tier suppliers. Second, focal firms do not have enough control over multi-tier suppliers. Third, lower-tier suppliers are not suffering from environmental pressure from their society, as they are often small and medium enterprises (SMEs), not well-known to the general public, and located in developing countries where environmental regulations are less demanding.

Finally, multi-tier suppliers are more likely to have unstable relationship with the rest of the supply chain, as they can be changed easily (Tachizawa and Yew Wong, 2014).To influence multi-tier suppliers' sustainability the firm has to choose the suitable type of governance to reach a whole sustainable supply chain. There are certain practices that have been previously identified, used by the focal firm to govern multi-tier relationships with suppliers. Not all of these practices are specifically developed for addressing sustainability, as some are used to manage other issues (e.g. cost). However, sustainability is one of the main objectives for multi-tier practices. These practices can be grouped in four basic approaches: "Direct", "Indirect", "Work with third parties" and "Don't bother".

Direct: In this approach, lead firms have a direct access to lower-tier suppliers. They can by-pass first-tier suppliers and establish a direct contact with lower-tier suppliers, to monitor, govern and collaborate with them to improve their environmental or social performance. Here the firm is using typical formal governance with its multi-tier supplier.

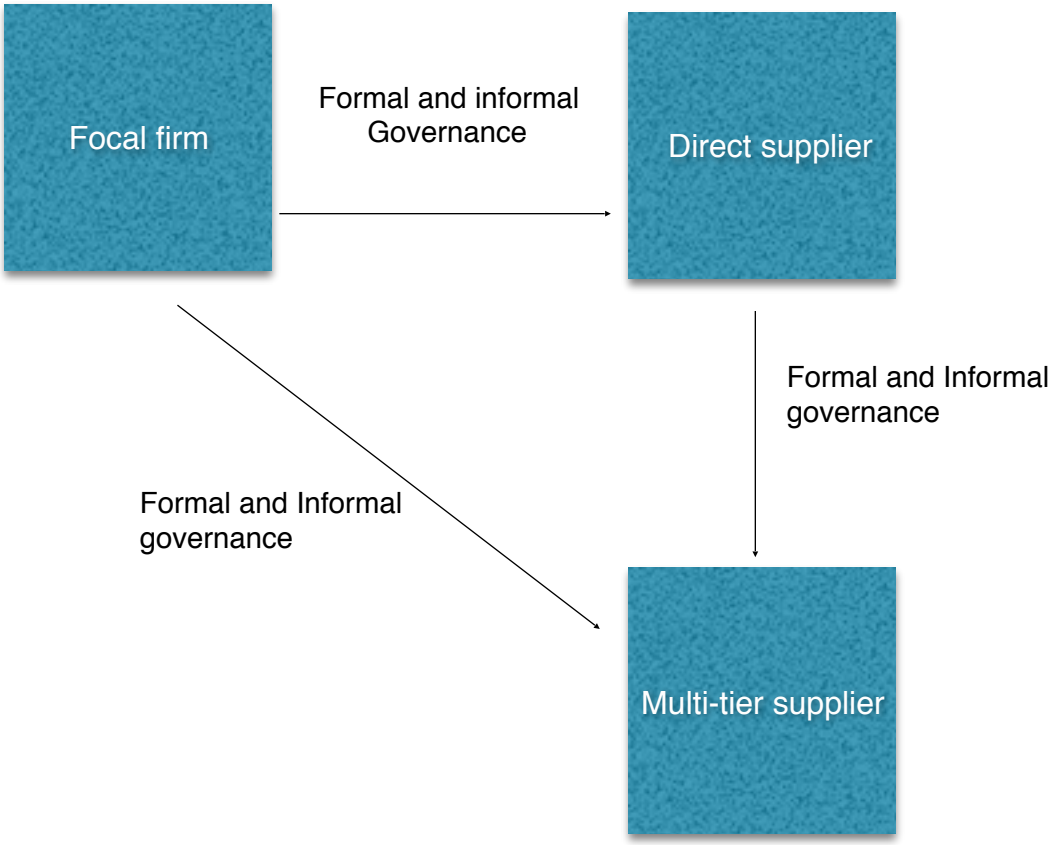
Indirect: This approach contact with lower-tier suppliers is performed indirectly through another supplier. It is difficult for a single company to manage compliance within the entire supply chain, thus cross-tier collaboration is essential. Therefore Standards are a major indirect mechanism of coordination of lower-tier suppliers. This sort of relationship is mainly depending on the direct

supplier, so the focal firm is using formal governance and asking for strict standards compliance that leads the direct supplier to force their sub-suppliers to follow these sustainability standards.

Work with third parties: Focal firms collaborate or delegate responsibilities to other organizations (e.g. NGOs, competitors, firms from the same industry, standards institutions, etc.) to enhance sustainability standards; apply industry self-regulations or voluntary standards ideas which are previously mentioned, monitor suppliers using third-party sustainability databases, etc. Even though companies can delegate some responsibilities to the third parties such as certification bodies, it is important for focal firms to give input to such third parties and even oversight their effectiveness. Here the focal firm is using complete informal governance with both their suppliers and multi-tier suppliers.

Don't bother: In this approach firms focus on first-tier suppliers and have neither information about lower-tier suppliers nor intention to influence them. This approach may be more applied to less complex supply chains (e.g. less tiers), or firms with less visibility to the final customer. (Tachizawa and Yew Wong, 2014).

Framework



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Complexity when Managing Rush Orders

Per Engelseth, Department of Logistics, Molde University College, Post box 2110, 6402 Molde, Norway. +4771214000, peen@himolde.no

Fahad Awaleh, Department of Business, University College of Southeast Norway, Post box 235, 3603 Kongsberg, Norway: +4731008000, fahad.awaleh@usn.no

Richard Glavee-Geo, NTNU-Norwegian University of Science and Technology, Post box 1517, 6025 Aalesund, Norway. + 4770161288, rigl@ntnu.no

Hao Wang, Big Data Lab, Norwegian University of Science & Technology, Post box 1517, 6025 Aalesund, Norway. +4770161534, hawa@ntnu.no

Abstract

Rush orders are handled by the supplier to meet customer requirements in a limited timeframe. Rather than considering rush orders as a deterministic planning problem in a reductionist analytical framework, a contingency-sensitive complex systems perspective highlights emergent and systemic networked interactions between the supplier and customers through this single case study of an advanced sanitary product supplier. A detailed case narrative describes and in brief reflects upon causes, effects, and solutions to rush orders. This provides grounds for describing how to conceptually model rush orders at the studied company using soft systems methodology to facilitate continuous innovation.

Keywords: *Rush orders, Networking, Soft systems methodology.*

Introduction

Rush orders are characterized by time constraints and organizational priority, managed to secure customer value. Supplier-relationship management, often termed sourcing, includes how to strategically handle orders that are often relatively unplanned due to degrees of demand uncertainty. The purpose of this paper is to empirically ground considering rush orders as a complex system. This research represents a stepping stone to more automated processing of rush orders through crafting first a conceptual model of rush orders. Such models provide foundation for modelling computer software application, linking at the operational level information technology with organization science. In this paper the foundations for such modelling of rush orders as an organizational processes following soft systems methodology (Checkland and Scholes 1991) are provided. Such modelling and future simulations applications are envisioned organised by the company as continuous innovations; a form of "Kaizen", of element of "lean" purchasing and customer services. Here we, however, do not dwell on considerations of applying lean to such administrative purchases, rather focus is directed how to design and organize this was to carry out the administrative process of handling rush orders. Since rush orders are handled through business relationships, this implies that this study concerns both a customer services (the supplier) and purchasing (the customer) perspectives. This implies a balanced view of these administrative processes in line with industrial network thinking (Gadde et al. 2010). In practical terms, sales and purchasing functionality are not prioritized at an operational level when constructing the frame of reference through the literature review.

The literature review considers in brief the following topics following an introduction on conceptualizing "rush orders": (1) customer services and planning, (2) uncertainty and managerial anxiety following rush orders, (3) economies of documentation and exchange, (4) product criticality and the customer voice, (5) uncertainty and prioritizing operations, (6) networked product complexity, (7) order process complexity. Following a statement of applied method, findings are provided as briefly commented descriptions of (1) causes, effects, and solutions to rush orders. This is followed by concluding applying soft systems methodology (Checkland and Scholes 1991) as direction for further research involving continuous modelling, simulation and developing interdependent administrative and logistics operations simultaneously using information technology (IT). This represents the core of a forthcoming full paper on how to manage rush orders *in* the complexities of a supply chain.

Literature review

Rush orders

Rush orders are received by the supplier, with time constraints as the main defining factor. The limited timeframe indicates a need to adapt to manage this form of supply. Wang and Chen (2008) provide a systemic framework from a single-firm perspective. It applies a neo fuzzy-based forecasting approach that describes how to manage rush orders by pointing out various causes and corresponding methods, including: Implicit customer's priority; concern for extra returns, outlays, or usuries; special orders authorized by higher-ups; and production disturbances. The classification indicates that rush orders, from the viewpoint of the focal firm managing downstream logistics to its customers, is not limited to only technical discrepancies. Rush orders may well be caused by marketing or managerial factors. Wang and Chen (2008) also describe three methods to solve the rush-order problem: (1) demand improvement of forecast accuracy; (2) approaches to control and receive rush orders; and (3) a mechanism to reserve capacity to improve suppliers' rush-order handling.

Customer services and planning

Svensson and Barfod (2002) argue that getting the right material at the right time is one main reason why rush orders are placed. If the general order has not been correctly filled, a rush order is needed to follow up on this. When material is missing, planned orders are delayed. Svensson and Barfod (2002) refer to this as a simple, but common problem that leads to delays in most cases. From the supplier's perspective, such problems must primarily be managed by the customer service function. Gourdin (2006) argues that a firm's customer service strategy is built around five key concepts: dependability, time, convenience, communications, and honesty, to achieve customer-responsive supply relationships to secure trust, which is expressed as loyalty in a business relationship. Wang and Chen (2008) seek to use advanced forecasting programs to help solve the rush order planning problem. In this paper this view is scrutinized based on empirical as well as theoretical considerations.

Uncertainty and managerial anxiety following rush orders

Since the rush order is a special order requiring special handling, a prioritized, ad-hoc form of organization is required when the rush order is filled (Yao & Lin, 2009). Rush orders are always at least to some degree unique supply chain events; uncertainty being a source of managerial anxiety. If such project-type of organizing is not planned, it must be developed as the order is received and filled. Chen (2010) also argues that prioritizing rush orders may provoke delays in scheduling standard orders. Kim and Duffie (2004) mention how an increase in unplanned orders such as a rush orders caused fluctuation in general lead times, significantly increased order backlogs, and greater variability in material quality, due to poor

fabrication coordination. Along this line, Ehteshami et al. (1992) argue that rush orders decrease the service level on standard orders, and increase inventory and supply delays, and the unpredictability of the production system. This leads to a higher share of rush orders tying up logistics, which may result in not enough customer-service resources devoted to standard orders. When a rush order appears, all customer-service hands are concerned with these orders hampering normal supply activities. This implies concern about balancing organizational resources between special and general orders. This also indicates that rush orders exist in a context of some managerial concern. Rush orders simply imply increased administrative workload.

Economies of documentation and exchange

From a supply chain management (SCM) perspective, considering rush orders as an exchange economy (Hammervoll 2014) directs attention to administrative process efficiencies, not only their output-focused effectiveness. Likewise as production, administration is considered here as operations. In these rush order handling processes the resources used and handled differ from production; it is in these cases of managing important to have the right documentation at the right time, to keep the flow of information going smoothly. According to Yan-Hai et al. (2005), the result of missing documentation causes planning problems, as well as poor logistics quality. This underpins the importance of having quality information that must be shared in the supply chain to execute the vital logistics of rush orders. This also implies a form of reciprocal interdependency in managing rush orders entailing need for mutual adjustments (Thompson 1967). Since these are special orders, it cannot be taken for granted that the supplier instantly understands the concept of the order, including how it is to be transported. The order may include a range of factors, such as goods, location, transport, payment and service options. All these factors can be negotiated. The more special the supplier perceives the order to be, the more mutual adjustment may be needed to get the order right. This indicates the importance of developed business relationships in such cases of hectic, because they are time-constrained, logistics operations to smoothly handle such complex interactions cost-efficiently.

Product criticality and the customer voice

Rush orders should also be evaluated in relation to the customer's perception of their criticality. This implies a value-orientation. According to Huiskonen (2001), criticality is divided into process criticality and control criticality. Process criticality is related to the consequences of a failure in which replacement is not readily available. The cost of production downtime is a major part of process criticality. Control criticality deals with possibilities to control production. This involves features of forecasting error, goods availability, lead times, and an array of logistical concerns. Criticality is associated with customer perceptions of lack of supply control or the consequences for production. When a rush order is received, a customer-responsive supplier will heed its customer's concerns by seeking to comply with its needs and deliver the goods in accordance with rush-order specifications. Lack of goods specificity affects complexity, since goods must be defined through interaction prior to supply. Demand patterns are associated with the degree of order uncertainty. Important features such as goods types, frequency, and volume. The customer voice explicitly or in a more subtle manner conveys a degree of criticality, affecting how the supplier should prioritize this order in a setting of numerous rush orders and general orders.

Uncertainty and prioritizing operations

Rush orders are also intertwined with uncertainty, since they suddenly may preoccupy the supplier's organization. According to Angkiriwang, et al. (2014), demand uncertainty is: "The

probabilistic nature of demand quantity, types, timing, and locations. Demand uncertainty could be in the form of errors in the demand forecast, changes in customer orders, uncertainty about the product specification/mix that the customers will order, and competitor actions regarding marketing promotion." However, this uncertainty is also associated with when the rush order manifests for the supplier and how it organizes this goods handling. This latter uncertainty concerns the entire organization. This implies that the organization must be able to quickly coordinate to handle the goods that are demanded by rush orders. Uncertainty must be handled for the supplier to find a viable mode of goods supply. Different solutions have been proposed to improve handling rush orders. Simangunsong et al. (2011) provide a list of strategies to cope with demand uncertainty that is typical of rush-order situations (1) postponement, (2) information sharing with downstream partners, (3) information and communication technology use, (4) use of strategic buffer stocks and lead-time management. Postponement may not intuitively seem to be a good fit for handling rush orders. However, negotiated timing of supplies becomes an issue in cases when goods are out of stock. These different factors are complementary and used to varying degrees. These all involve strategic investment, variation, and value that may be analysed through considering supply operations costs and benefits (i.e. "customer value"). Wang and Chen (2008) mention buffering inventory as a viable solution, but include that the supplier could reserve some of its production capacity to handle rush orders. The supplier should also develop specific criteria to handle incoming rush orders, such as the size of the customer, amount of the product ordered, or the profit it would create. Yan-Hai et al. (2005) state that rescheduling the manufacturing system may help support the on-time execution of rush orders, which also applies for standard orders. Tryzna et al. (2012) argue that work-in-progress inventory must be at an acceptable level, so both rush and standard orders may be fabricated in a balanced manner when there is a large amount of orders. Rush orders also represent a fabrication-planning problem that should be taken seriously in advance, due to the delivery time, change in inventory level, and lack of capacity or need for it be re-arranged. Finally, this understanding of fabrication planning includes taking into consideration the impact rush orders have on current and potential customer relationships. The criticality of an order may vary, and a high degree of criticality usually implies that a rush order is needed to be carried out. The causality between uncertainty and the use of rush orders is more unclear, but unexpected orders, when they occur, may imply that this is a rush order. This needs, however to negotiated with the customer.

Networked product complexity

Closs et al. (2008) define product complexity as "from a multiplicity of elements, as well as from relationship among the elements," meaning that it can be organizationally challenging to keep track of all production system elements. Blackenfelt (2001) describes product complexity as the number of parts and relationships between the parts, but complexity can also be related to the issues of product variety, since it directly affects complexity. As part of a supply-chain flow domino effect, the more complex a product is, the greater the risk of more sub-suppliers rendering fabrication coordination more challenging. A complex product is potentially embedded in a more complex supply network. According to Svensson and Barfod (2002), the traditional way of producing a complex, highly customized product has shifted from material processing to competence in managing product information. Closs et al. (2008) argue that market diversity creates higher complexity due to increasing product variations. To handle product complexity Closs et al. (2008) note that managers may seek to limit requirements by balancing this with customer demands for supply adaptation. It is difficult to optimize any level of product complexity to ensure the right amount of cost and revenue. Blackenfelt (2001) mentions modularization as a compromise, ensuring customer

responsiveness and cost efficiency. Product design and information exchange are ways to handle product complexity in cases of relatively severely time-constrained supply. Rush orders are often associated with deliveries of spare parts. According to Fortuin and Martin (1999), companies may have a catalogue consisting of 100,000 spare parts, but only have 50,000 actually in stock. The remaining spare parts can be ordered, but would then need to be manufactured. This implies a need for supply postponement, a strategy that seems to not be a good fit for rush orders. Fortuin and Martin (1999) argue that there is a need for categorization to know which parts to stock. Huiskonen (2001) specifies a classification system, involving only four control characteristics: (1) criticality, (2) specificity, (3) demand pattern, and (4) parts value. This implies differentiating spare parts supplies in relation to these criteria in regard to the effects they have to supply quality.

Order process complexity

In addition to product complexities, it is also vital to consider rush order process complexity. In a supply system, complexity must be defined different from product complexity. In this case, a product is a type of good associated with physical distribution, which is a static artefact. However, the system is dynamic. From a process viewpoint, complexity is defined as: "A property of an open system that consists of a large number of diverse, partially autonomous, richly interconnected components, often called agents, has no centralized control and whose behaviour emerges from the intricate interaction of agents and is therefore uncertain without being random" (Rzevski & Skobelev, 2014, p.5). Fundamental to this view is that conceptually enhancing complexity is the foundation for developing a complexity-sensitive way to manage rush orders can be developed, supported by IT software. Rezevski and Skobelev (2014) point out that the key features of complexity are openness, diversity, partial autonomy and interconnectedness of agents, lack of centralized control, and emergence. This component interlinking entails interdependence. Management must consider how to handle processes in which components continually change regarding not only time, place and form, but also how they are interconnected (pooled) and perceived. In a complex system, not only is service transformed in production, but how it is evaluated may also change over time, affecting production. Interaction, matching uncertain demand with anxieties of supplier management can be solved through using flexible resources.

Methodological considerations

A single case study of rush orders was carried out, based on the general ideographic stance taken in this research. The study began Jan. 19, 2017 when a semi-structured group interview was conducted in Norwegian with six employees at the firm's main office. Two persons from the research team took part in this visit. Our contact person was present throughout the whole interview. The corporate manager was present during the first hour and 25 minutes, while the rest were interviewed during the remaining hour and 35 minutes. Interviews were not conducted alone with each employee because of their busy schedules. Since this was a group interview, the interviewees complemented each other during the interview. They filled in information for each other, and discussed various perceptions of rush orders often associated with handling different types of orders and customers. Another positive result from the group interview was that, through careful guidance by the research team, the interviewees did not repeat themselves or overlap their responses. Group interview mediation was the responsibility of the two moderators from the research team. It provided an overview of the company functions and the firms with which it works in the supply chains. A list of potential informants among their customers was also provided.

After the interview, our contact person took us to the production and warehouse department, where we observed how the production was performed. Our contact person also showed us some of the products that were discussed during the interview so that we could get a clearer picture of what they had been talking about. Supplementary brief interviews were carried out with customers, represented by either domestic dealerships or representatives abroad. An adapted customer interview guide for dealers and representatives was created. This interview guide was sent in the same form by email to these customers, and request was made to carry out an interview using Skype. All the asked customer informants agreed to take part in the study. However, they preferred to respond to our questions by email, rather than by Skype. These customers were partially motivated by the fact that this research could help improve the handling of rush orders. The interviewees included four domestic retailers and three international representatives.

This paper highlights the emergent networked time-constrained interactions to supply spare parts between Jets AS, a Norwegian supplier of advanced sanitary systems that limit water usage to its network of domestic and international customers. First, analysis seeks to evoke the empirical state of (1) causes, (2) effects, and (3) solutions related to rush orders. Empirical raw data, other than a brief introduction of the company and its rush order handling challenge, a case narrative including quotes of the informants, are not provided in this paper due to its limited text length. This will be included in a future full paper version.

Brief empirical overview

The sanitary product supplier operates in two market segments organized as departments: (1) ship & offshore; and (2) land & transport. The difference between a traditional sanitary product that uses gravity and a vacuum sanitary product is that the latter product uses air instead of water to handle human waste. Only a small amount of water is used to clean the bowl in a vacuum system. The supplier has a network of domestic retailers and global representatives. Some of the foreign representatives support both ship & offshore, and land & transportation segments. There are 87 domestic dealerships, 85 of which only deal with systems for the cabin-home segment. The other two deal with both the cabin-home and the larger building segment. These dealerships are usually stores that carry sanitary systems and plumbing equipment for cabins. The supplier does not have a formal, explicit definition of what they classify as a "rush order". It perceives rush orders as one of many services it provides to its customers, without giving it much analytical thought. Still, it has a conception of supply timing, based on the lead time the within which orders need to be filled. The customers that place these rush orders usually contact the sales or aftersales department when they place such orders. These types of orders demand a maximum of 48 hours to answer the customer inquiry in case delivery is impossible the same day. Out of 8,506 orders in 2016, 682 of these orders were ad-hoc classified as rush orders, or approximately 8 percent of all orders. The rush-order invoice amount was 3.8 million NOK, out of a total invoice amount in 2016 of 246 million NOK. Out of the 682 rush orders, 507 were delivered in Norway, and the remaining 175 rush orders were delivered to other countries. Some orders delivered in Norway were addressed to airports and be shipped outside of Norway.

Findings - abstract

Causes
It is almost impossible to plan rush orders, which makes the time threshold difficult to predict, as well as how it will affect normal operations. Rush orders represent an everyday reality of

production at the studied company. The company also has no clear concept of rush orders and has not classified what defines a rush order. It is simply a service they provide to their customers. It is also difficult to define a rush order, since there are different degrees of order urgency, compared to other orders. Classifying a rush order is related to a continuum regarding time constraints. The distinction of what defines a rush order in the supply chain becomes increasingly unclear when considering when orders must be fabricated. Such orders must be produced in the factory, which takes time. Through exchange perceptions of urgency are manipulated. In production, rush orders are prioritized before standard orders, implying that they not follow the standard time guidelines as applied to in-stock spare parts. In fact, it is the limited conceptual understanding regarding what this actually constitutes "rush orders" and what differentiates this type of order from standard orders also hampers understating root causes of rush orders. Rush orders are, regarding its organizational symptoms (what is immediately perceived), intertwined with uncertainty, both regarding their occurrence and their managerial interpretation. Customers have a more clear understanding of the causes of rush orders, which were described in the customer interviews. They are more close to its root cause. Many of the incoming rush orders were a direct consequence of their dealers and representatives not keeping stock of the most important parts. If they kept stock of the most crucial parts, it might help reduce the demand uncertainty. In 2016, the supplier had approximately 8 percent of their orders as rush orders, which disturbs the normal production line and might cause delays. The ship-&-offshore segment has greater uncertainty, due to the fact that most products for that segment are made to fit a custom-designed installation. On the other hand, the land-&-transportation segment, in which five to six standard products are used, has a lower uncertainty level.

Effects

The supplier has no clear set of standards that explicit tells which service level they are providing to their customers. The supplier sets the ideal service level at “100 percent.” This is clearly more a motivating objective than a realistic practicality. It also seems that the supplier has not been able to handle the transition to being an innovator in the sanitary system market, going from only a few customers, to now possibly having too many. Providing excellent service to a few customers is manageable. Complexity increases as the supply system grows, rendering it increasingly difficult to plan and manage, in accordance with pre-set supply processes. The empirical findings show that the dealers and representatives express that they are very satisfied with the supplier’s service. They get quick response when they need help with something. A technical issue with an installed sanitary system is a common cause for a rush order. The supplier then responds with a willingness to fill their customers’ need for quick service. This might be one of the underlying reasons why the supplier has a problem with rush orders. They seem to push the rush-order service. They agree to rush orders that could have been sent as standard orders. This also implies organizational consequences. Resources could have been more economically used if an order that was not critical could have been shipped by standard ordering procedures. Some representatives or dealers also tend to send requisitions too late and a rush order becomes an emergency through such exchange process timing. This causes an enormous stress on the supplier’s production system. Sharing information regarding production and delivery time could have stopped the rush order, since customers might then state their spare-parts needs earlier on. Withholding the right information at the right time seems to be a problem for both the supplier, and their representatives and dealers, which makes them unable to create a responsive supply chain. This is an example of discrepancies associated with the exchange economy (Hammervoll, 2014).

Solutions

Since supply uncertainty, especially in the ship-&-offshore segment is high, is not likely to eliminate all rush orders from occurring. The uncertainty is supply chain-contingent environmental characteristic the supplier has limited influence upon. Some influence may be used to change how customers order their spare paper as indicated in the preceding section. From our empirical findings, there are some solutions already in place, but also some potential for more solutions. The retailers and foreign representatives provided some solutions. Davis (1993), and Wang and Chen (2008) argue that using inventory can be a solution to both prevent rush orders and smooth out variation due to supply and demand. Some retailers and representatives have inventories with spare parts. Our findings show that inventories with finished products/systems are organizationally challenging, due to order variation and lack of standardization. The resources are only weakly integrated, so are difficult to pool. Customers have some finished products in the land-&-transportation segment, but there is great variation in the ship-&-offshore segment. Wang and Chen (2008) also argue that if suppliers reserve management and production capacity, it could help cope with rush orders. The supplier attempted to do this and stated that employees will work overtime, if needed. The risk of having inventory and reserving capacity is that they will not be used, and money will be wasted (Wang and Chen, 2008).

Solutions to cope with demand uncertainty include postponement, information sharing, buffer stocks, and lead-time management. Postponement incurs accepting delays, which would mean a negotiated acceptance by the customer to accept waiting for an order that may be critical by an agreed-upon time. Variation of demand is uncertain, so it is difficult to predict rendering and planning. It is possible to have extra inventory (buffering) to keep rush orders under control. The supplier never knows when unexpected repairs shows up, so buffer stocks would safeguard against a meltdown in the system. The customers also experiences intermediaries, so demand is volatile and often unexpected.

Lead-time management is, expressed by the company, that it could help handle the level of uncertainty by controlling their representatives and dealers to create a space between the actual time it takes and what their customer knows. This would help the supplier keep rush orders handled within a reasonable time. Unplanned orders, such as rush orders, would be a direct cause of how lead times vary as the backlog increases and work in progress goes up and down (Kim and Duffie, 2004). Lead-time management means using flexible organizational and technical resources to cut down the time of delivery of unplanned orders. Focus should be directed toward developing production flexibility to reduce lead time in urgent situations. This includes both logistical and fabrication flexibility. It also involves developing efficient processes to manage production (logistics and fabrication) flexibility. This demands effective information systems. A key to this development is the use of product and information standards in unison to facilitate efficient, effective resource pooling.

The supplier's idea of introducing a rush-order fee was discussed with the customers. Unsurprisingly, the customers' immediate thought was that the fee was to cover some of the costs for having a high service level, which was starting to cost a substantial amount of money. In a manner, such a fee would elevate organizational awareness of the rush order and motivate customers to avoid rush orders. The interviews with customers showed clearly that improved interaction between the suppliers and their customers could help reduce supply uncertainty, as well as create orders in a standardized information format, easing interpretation and further ordering. Introducing a fee could be helpful in terms of eliminate some rush orders that actually were not that urgent. A rush-order fee could also solve the issue

of all orders being communicated as rush orders, even though they aren't. The findings from the interviews with the retailers and the representatives did not provide a clear indication of whether or not the amount of rush orders would decrease if an order fee was imposed. The majority of the customers were negative toward introducing such a fee. It could therefore also have negative effects on relationships with the supplier.

Concluding remarks

Since uncertainty is one of the prime features of customer relationships, forecasting systems are limited in detecting emerging issues of both supply demand and its technical provision, although they provide valuable management indicators directing supply-related activities,. The main limitation regarding Wang and Chen's (2008) approach is that it implies a deterministic single-firm focus.

This study attempts to understand supply-process coordination as a complex system embedded in SCM. This implies a fundamental view of rush orders as an inter-organizational problem. In addition, this study ultimately seeks to consider how such rush orders can be a complex phenomenon in this SCM context. Being conceptually grounded in SCM implies that the analytical focus is directed toward features of supply-chain integration and collaboration to coordinate rush orders as supply *processes*, rather than directed toward IS technicality.

When viewed as complex entities, the term "supply chains" (a supply system) implies a fundamental view that management should normatively-speaking be more preoccupied with achieving integration; connectivity and sufficient resource capacity (people, tools and facilities) for adaptation founded on resource flexibility characteristics, rather than in a deterministic fashion planning the organization away from the perceived managerial threat of rush-order problems. This represents theoretically a movement away from a reductionist view of management with process planning to developing organizational sensitivity of emerging processes needed to navigate in complex supply networks (Rzevski & Skobelev, 2014). This complexity may to a degree be automated using complex systems software including system agents as artificial intelligence resources.

Solving the problem of rush orders is in this research therefore, as stated, not considered as a planning problem following a deterministic line of thought. Instead, following a complex systems line of thought, process emergence associated with always unique combining of resources following industrial network thinking (Ford et al. 2017). The paper confronts the complexity rush order handling and seeks in the upcoming research to model, and thus help point out how to manage in a network characterised by this complexity of rush order handling found in the real business world. The upcoming paper will then discuss information system development; alternative IT-enabled designs of exchange processes supporting the revealed complexities and time constraints of rush orders. Future research involves developing a conceptual model following soft systems methodology applied in an organizational context seeking continuous improvement of rush order handling.

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The role of technical capability and locus of initiative on knowledge integration with customers in collaborative product development

Mohammad H. Eslami[1] and Nicolette Lakemond[2]

[1] *Department of Management and Engineering, Linköping University, Sweden – Tel. +46 13282537, mohammad.eslami@liu.se,*

[2]*Department of Management and Engineering, Linköping University, Sweden – Tel. +46 13282525, nicolette.lakemond@liu.se*

Summary

This study examines the extent to which technical capabilities and the locus of initiative in product development collaborations influence knowledge integration activities with customers. Based on a survey of 216 Swedish manufacturing firms, we find empirical support for the importance of the locus of initiative, technical capabilities of firms as well as their customers to enhance knowledge integration. In addition, firms with high technical capability that work with customers that have a similarly high technical capability tend to collaborate based on a higher degree of knowledge integration activities than when the firm's technical capability of customer is low.

Keywords: Knowledge Integration, Customer Collaboration, Product Development, Technical Capability, Locus of Initiative

Introduction

Studies in the field of innovation have identified customers as one of the key collaboration partners of manufacturing firms (Un, Cuervo-Cazurra and Asakawa, 2010; Laursen and Salter, 2006; Homburg and Kuehnl., 2014). Firms that collaborate with their customers during product development are better able to interpret market trends, understand customer demands, develop customized products, and reduce risks related to design that lead to poor functionality (e.g., Blazevic and Lievens, 2008; von Hippel, 1986; Lin, Chen and Kuan-Shun Chiu, 2010; Lau, 2011). Thus, firms increasingly collaborate with their customers when carrying out product development activities to capture customers' knowledge about possible future products.

In fact, in collaborative relationship with customer, manufacturing firms do not only contribute with their knowledge, but they also use the advantage from a systematic knowledge exchange with customers (Mahr, Lievens, and Blazevic., 2014; Cui and Wu, 2016; Eslami and Lakemond, 2016). The majority of the studies in this field of supply chain management and purchasing are performed from a customer's perspective, while studies conducted from the manufacturing firm's perspective are less common with some exceptions (Aarikka-Stenroos and Jaakkola, 2012; Laage-Hellman., Lind and

Perna, 2014). Hence, it is necessary to understand the conditions when firms face integrating customer knowledge into their product development process.

Nevertheless, many firms find it challenging to understand how to reap the maximum benefit from knowledge integration with customers. In fact, the growing importance of this systematic knowledge exchange between firms and customers require an understanding of the conditions and factors under which firms integrate the knowledge of their customers in their new product development process. For instance, a wide range of factors can affect customer collaboration in product development, such as a lack of partner commitment (e.g., Krause, Handfield and Tyler, 2007), a lack of internal integration (e.g., Mishra and Shah, 2009), and the customer's low level of technical capability (e.g., Wagner and Hoegl, 2006; Wagner, 2010; Wynstra, Von Corswant and Wetzels, 2010). Moreover, firms wishing to integrate knowledge with customers must have the requisite technical capabilities that allow sharing and combining this knowledge in product development activities (cf. Grant and Baden-Fuller, 2004; Eslami and Lakemond, 2016). In addition, the success of collaborative development is contingent on the customer's ability to contribute to knowledge integration (cf. Peled and Dvir, 2012), while the commitment of customers seems to play a role. When customers are reluctant to commit to a relationship, they are unlikely to be willing to invest resources in collaborative product development (Krause, Handfield and Tyler, 2007).

Despite growing attention paid to the need to integrate customer knowledge, empirical evidence of the role of technical capability and customer initiative in knowledge integration activities in product development is scarce. Indeed, a detailed analysis of the relationships among a manufacturing firm's capabilities, its customers' capabilities, customer initiative, and knowledge integration activities is lacking. Based on this gap in the body of knowledge on this topic, this study investigates the extent to which the above-mentioned factors affect knowledge integration activities with customers. By deriving data from a cross-sectional survey of 216 Swedish manufacturing firms, we elucidate how technical capability and the locus of initiative influence knowledge integration and how matching degrees of capabilities influence the use of knowledge integration activities.

The remainder of this paper is organized as follows. Section 2 presents the theoretical framework of this study, taking the knowledge-based view (KBV) of the firm as a starting point. This is followed by the development of the hypotheses, before presenting the study methodology and data collection procedures in Section 3. Finally, after discussing the study findings in Section 4, the work concludes with suggestions for future research in this field in Section 5.

Theoretical framework and hypothesis development

Knowledge integration with customers in collaborative product development

In the context of this study, and building on a knowledge-based perspective, collaborative product development with customers relates to the joint acquisition of knowledge and skills by firms and their key customers with the aim of developing a new product (Rindfleisch and Moorman, 2001; Wagner and Hoegl, 2006; Homburg and Kuehnl, 2014). The outcome of this collaboration is value creation, which is maximized by using distributed knowledge (Emden, Calantone and Droge, 2006). As a consequence, and in line with the growing awareness that firms must rely on external knowledge (e.g., Chesbrough, 2003; Grant and Baden-Fuller, 2004), knowledge integration is crucial to capturing the benefits of customer collaboration.

This study adopted the theoretical lens of the knowledge-based view (KBV) of the firm, which recognizes knowledge as a critical source of firm value (Grant, 1996). This lens suggests that firms must be considered to be social communities in which knowledge is combined and synthesized into economically valuable products (Kogut and Zander, 1992). According to the KBV, it is more efficient to integrate the internal knowledge of individuals into an organization than to attain external knowledge and combine it with internal knowledge (Kogut and Zander, 1992). However, there is growing awareness that not all relevant knowledge resides within the boundaries of a firm and that firms may need to rely on external knowledge (e.g., Chesbrough, 2003, Grant and Baden-Fuller, 2004). Therefore, firms are required to collaborate with external partners such as customers, as their input helps apply internal knowledge more effectively (e.g., Lukas and Ferrell, 2000). Firms that implement this approach can not only increase their knowledge but also create new avenues for other business opportunities (Cohen and Levinthal, 1990). Hence, the KBV has been extended to inter-firm collaborations (e.g., Grant and Baden-Fuller, 1994; Dyer and Singh, 1998), arguing that firms can achieve competitive advantage through external knowledge integration. Based on this perspective, an understanding of collaborative product development requires an understanding of the knowledge integration activities that firms carry out together with customers, including the prerequisites for these activities to take place.

Previous studies have demonstrated that customers are one of the main sources of knowledge when it comes to product characteristics and customer needs (Nambisan, 2002; Blazevic and Lievens, 2008). Integrating customer knowledge can therefore help firms better address the challenges of product development. In particular, firms that collaborate with their customers are better able to understand the design challenges, which in turn results in products that better serve the expectations of current and future markets (Veryzer and Borja de Mozota, 2005).

Collaboration with customers in product development necessitates that firms share and combine internal and external knowledge in order to create new knowledge (cf. Tasi, 2001). Such knowledge integration is an interactive process, where specialized

knowledge residing in manufacturing firms and customers is shared and combined into new knowledge (cf. Okhuysen and Eisenhardt, 2002; Tiwana and Mclean, 2005). This process of knowledge integration can be challenging, however. For instance, an incongruence or lack of common knowledge between firms and their customers might exist. To mitigate this problem, technical capability allows firms to achieve better knowledge integration (LaBahn and Krapfel, 2000).

Hypothesis development

Firm technical capability

Technologically competent firms gain an advantage when collaborating with customers in product development (Schiele, 2006; Wagner, 2010). Collaboration with customers is especially appropriate when a close link between a firm's technical capabilities, which comprise a combination of knowledge and skills (Teece, 1998), and a customer's needs exists. Technical capabilities represent the type of knowledge that may allow a firm to create value, which is embodied by an individual's knowledge and skills and embedded in technical systems (Johnsen and Ford, 2006). In this work, firms' technical capabilities refer to knowledge-based engineering proficiency with new technologies that can be used to react to emerging technologies during collaborative product development (LaBahn and Krapfel, 2000).

A firm's technical capability influences its ability to absorb the technical knowledge of its customers (Lin and Huang, 2013; Eslami and Lakemond, 2016). When a firm's technical capability is insufficient, it will have difficulties realizing a technology's potential, discovering the complementarities of internal and external knowledge, and integrating this complementary knowledge during collaborative activities. Indeed, firms that have a high degree of capability are best able to pursue knowledge integration with customers. Consequently, we formulate the following hypothesis:

H1. A firm's technical capability has a positive effect on knowledge integration between firms and customers in collaborative product development.

Customer technical capability

Customer technical capability refers to the degree to which the customer understands the product that needs to be developed. For example, a customer that can validate the product's architectural choices and formulate design requests is deemed capable to positively contribute to the collaborative effort (cf. Peled and Dvir, 2012). Customers with a high degree of technical capability can help design new product and production processes, which may prevent potential failures because of poor design and product functionality. Therefore, the technical knowledge of customers facilitates knowledge integration in product development.

There is a positive link between a customer's knowledge and the value of its contribution to a firm's activities (Athaide and Klink, 2009; Smals and Smits, 2012).

Athaide and Klink (2009) reported that the contribution of customers with high technical capability helps firms adapt customer needs and mitigate environmental uncertainty. Likewise, Smals and Smits (2012) stated that collaboration with capable customers increases the likelihood of creating value. In fact, some level of technical capability is required for the customer to contribute and integrate knowledge with the firm (cf. Brusoni, Prencipe and Pavitt, 2001). Consequently, we formulate the following hypothesis:

H2. A customer's technical capability has a positive effect on knowledge integration between firms and customers in collaborative product development.

Congruence of firm and customer technical capabilities

Although both firms and customers technical capabilities are important factors in collaborative activities, these have, to our knowledge, not thus far been addressed simultaneously. The combined effect of a high degree of firms and customers technical capability is expected to bolster the possibilities of conducting knowledge integration activities. Consequently, we formulate the following hypothesis:

H3. Simultaneously high degrees of firms and customers technical capabilities are associated with higher levels of knowledge integration activities than when one or both have a low degree of technical capability.

Role of the locus of initiative

Collaborating intensively with customers to enhance innovation outcomes during product development requires commitment from both parties (Gadde and Snehota, 2000). According to Muthusamy, Hur, and Palanisamy (2008), commitment based on personnel and technology can improve knowledge integration between firms and customers and thus allow them to create new knowledge. Research has shown that customers are more willing to collaborate with manufacturing firms that are more proficient in collaborating with customers in product development (e.g., Walter, 2003). Firms can become proficient in collaborating with customers by understanding their business environments and profit opportunities. In many cases, this is reciprocated by the customer's willingness to contribute to the product development process. When firms and customers commit their resources and the relationship is driven by a learning intent, the outcome is more integrative (Lagrosen, 2005; Huang and Newell, 2003). Consequently, a customer's commitment of resources and willingness to contribute can increase the degree of knowledge integration.

According to Eslami and Lakemond (2016), commitment and willingness to collaborate are related to the locus of initiative. Customers that actively take the initiative for the project tend to adopt a more active role and are more willing to integrate their knowledge. A similar finding was reported by Brockhoff (2003), who argued that if the customer takes the initiative, firms can expect to receive feedback and suggestions on product characteristics. In this situation, the goal of knowledge integration with

customers shifts from obtaining expectations and technical requirements to product feasibility and evaluating the optimization of the physical product (Lin and Huang, 2013). Hence, based on the limited available evidence, we propose the following hypothesis:

H4. The locus of initiative residing on the customer side has a positive effect on knowledge integration between firms and customers in collaborative product development.

Research Design

Data collection

The data were gathered through a cross-sectional survey of firms operating in the Swedish manufacturing industry. The population included all Swedish manufacturing firms (codes 10–32 NACE Rev. 2) having more than 50 employees. Data collection was based on a randomized representative sample of 1730 manufacturing firms. 700 manufacturing firms have randomly drawn from the target population. The data were collected via questionnaires distributed by emails to the respondents of randomized 700 manufacturing firms. Respondents were mainly R&D managers and other employees involved in collaboration with customers related to product development activities. The overall time to respond the survey was about 20 to 30 minutes. At the beginning of the process of data collection, each potential respondent was contacted by phone and we have informed about the aim and content of the study. In case that the respondent could not contribute in the survey (e.g., due to heavy workload or low interest), we were asked to suggest another possible person who could provide insights of value for the research study.

To increase the response rate, the initial invitation was followed up by three reminders, resulting in 216 valid questionnaires. The survey questionnaire was evaluated before the main study in a pilot test in which knowledgeable academic/practitioner colleagues and targeted respondents from selected firms took part. Their feedback helped refine the data collection instrument. The questionnaire was administrated through an online survey instrument. The links to the survey were sent by email to all identified individuals. The unit of analysis was the relation between manufacturing firms and their key customers in collaborative product development.

Measurement

The questionnaire items pertaining to both the independent and the independent variables were based on responses on a five-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The dependent variable, knowledge integration, was operationalized by three questionnaire items aiming to elucidate the extent to which employees and their customers jointly discuss errors and failures and talk about new programs and activities in order to develop new products and concepts (Akgün et al., 2007).

Firms and customer technical capabilities as well as the locus of initiative on the customer side served as the independent variables. We have measured both firms and customer technical capabilities using five items: engineer's proficiency with the latest technology, engineer's skills at creating technological innovation, capability of incorporating external technology into a new product, offering engineering support, and responding quickly to technological changes (LaBahn and Krapfel, 2000). In fact we have asked representatives on their firms technical capability and their perception of their customers. The third independent variable, the locus of initiative on the customer side, was assessed by two items: (1) customers present ideas and suggestions for new product function and (2) customers present ideas and suggestions for new materials used to create products (Freng Svendsen et al., 2011). Table 1 reports the descriptive statistics of the items of the main constructs.

Table 1. Descriptive statistics for the main constructs

Items	Number	Mean	Standard deviation	Median
Firm Technical Capability (FTC)				
Proficient with the latest technology	216	3.157	.842	3.0
Skilled at creating technological innovations	216	3.491	.846	4.0
Incorporate external technology into a new product	216	3.094	.979	3.0
Offer high degree of engineer support to customers	216	3.708	.999	4.0
Respond quickly to technological changes	216	3.474	1.001	3.0
External Technical Capability (CTC)				
Proficient with the latest technology	216	2.966	.9067	3.0
Skilled at creating technological innovations	216	2.938	.9052	3.0
Incorporate external technology into a new product	216	2.928	.8838	3.0
Offer high degree of engineer support to customers	216	2.976	.9273	3.0
Respond quickly to technological changes	216	2.818	.8687	3.0
Knowledge Integration (KI)	216			3.0
Discuss and analyze errors and failures with customers	216	3.625	1.057	4.0
Discuss new ideas and activities with customers	216	3.130	1.092	3.0
Develop new product development concepts together with customers	216	2.762	1.114	3.0
Locus of initiative on the customer side (LIC)				
Customers present ideas for new product features	216	3.349	1.067	3.0
Customers present ideas and suggestions for new materials and product production	216	2.374	1.069	2.0

Technological uncertainty and product uncertainty were used as control variables, which capture the external and internal contexts of customer involvement. To define technological uncertainty, respondents were asked to rate the level of technological innovation, product complexity, pace of technological changes, and opportunities for technological changes in their industry (Song and Montoya-Weiss, 2001). Product uncertainty was measured by asking respondents to rate the product complexity, degree of product development, maturity of technology processes, pace of technology changes, and degree of the engineering content of products (Koufteros, Vonderembse and Jayaram, 2005).

As the distribution between industries is skewed, and sometimes few firms only represented some industries, we split the firms into four clusters. Therefore, We included industry as a control variable, with low tech industry as the baseline. Based on NACE Rev. 2, participating firms were grouped into low tech, medium-low tech, medium-high tech, and high tech firms, following the approach applied by Eurostat and Statistics Sweden (SCB, 2014), which uses technological intensity as a selection parameter. 65 firms related to codes 10–19 and 31–32 were categorized as low tech (e.g., furniture, food). 56 firms related to codes 19 and 22–25 medium-low tech (e.g., petroleum, plastics) were identified. 80 firms related to codes 20 and 27–30 were categorized as medium-high tech (automotive and electric products). And 15 firms related to codes 21 and 26 are identified as high tech (e.g., pharmaceutical, electronics,

computer, and optical products). Finally, firm size and turnover (in natural logarithms) were obtained from a national database and applied as additional control variables. Table 2 shows the factors and factor loadings, while Table 3 presents the descriptive statistics of the variables and their correlations.

Table 2: Factors and factor loadings

	KI	*FTC*	*CTC*	*LIC*	*TU*	*PU*
Knowledge Integration (KI)						
Discuss and analyze errors and failures with customers	.752					
Discuss new ideas and activities with customers	.852					
Develop new product development concepts together with customers	.845					
Firm Technical Capability (FTC)						
Proficient with the latest technology		.749				
Skilled at creating technological innovations		.816				
Incorporate external technology into a new product		.722				
Offer high degree of engineer support to customers		.748				
Respond quickly to technological changes		.712				
External Technical Capability (CTC)						
Proficient with the latest technology			.885			
Skilled at creating technological innovations			.907			
Incorporate external technology into a new product			.907			
Offer high degree of engineer support to customers			.849			
Respond quickly to technological changes			.822			
Locus of Initiative on the Customer Side (LIC)						
Customers present ideas for new product features				.840		
Customers present ideas and suggestions for new materials and product production				.840		
Technological Uncertainty (TU)						
High level of technological innovation in our industry					.832	
More complex products are provided in our industry					.765	
The technology in our industry is changing rapidly					.861	
Technological changes provide large opportunities in our industry					.759	
Product Uncertainty (PU)						
We provide complex products rather than simple ones					.	.786
Our new products have a high degree of innovation						.828
Product development has a high degree of engineer content						.773
Our products are based on technologies that are changing rapidly						.703
Variance explained	66.8%	56.3 %	69.9 %	70.5%	64.8%	59.9%
Cronbach's alpha	.752	.801	.923	.601	.774	.817
N	216	216	216	216	216	216

Table 3. Descriptive statistics and correlations

	N	Mean	Std. Dev.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.
1. Knowledge integration	216	.000	1.000	1	.490***	.491***	.533***	.325***	.347**	-.174*	.096	.021	.115	-.046	-.093
2. Firm technical capability	216	.000	1.000		1	.342***	.413***	.237***	.534***	-.228**	.155*	.061	.036	.057	.020
3. Customer technical capability	216	.000	1.000			1	.379***	.420***	.371***	-.120	.060	.026	.069	.033	-.046
4. Locus of initiative on the customer side	216	.000	1.000				1	.274***	.341***	-.088	-.004	.081	.016	.078	-.018
5. Technological uncertainty	216	.000	1.000					1	.563***	-.014	-.132	.091	.081	.061	.008
6. Product uncertainty	216	.000	1.000						1	-.270**	.000	.223**	.071	.105	.060
7. LowTech	65	.300	.459							1	-.392***	-.516***	-.179*	-.010	.033
8. MedLowTech	56	.259	.439								1	-.444***	-.154*	.052	.081
9. MedHighTech	80	.370	.484									1	-.203**	.012	-.043
10. HighTech	15	.069	.254										1	-.094	-.120
11. Size log	216	2.18	.482											1	.892***
12. Return on sales log	216	5.57	.609												1
	N	Mean	Std. Dev	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	12.

Note: *P < 0.05, **P < 0.001, ***P < 0.001

Data analysis

The descriptive statistics in Table 3 show that firms seem to evaluate their own technical capabilities as marginally higher than those of their customers. Furthermore, firms discuss and analyze failures with customers more often than they discuss new ideas, carry our activities, or develop product concepts together. Related to the locus of initiative on the customer side, customers present new ideas for product features more commonly than offer suggestions for new materials or advice related to production.

To test the presented hypotheses, we performed a regression analysis on the complete dataset (see Table 4). Since our dependent variable is continuous, we employed ordinary least squares estimations. Model 1 contained the control variables only, while Models 2 and 3 included the effects of firm and customer technical capabilities, respectively. The regression in Model 4 included the effect of the locus of initiative on the customer side on the outcome of knowledge integration with customers. This approach helped compare the models and allowed us to predict the outcome variable (Field, 2013).

To analyze the importance of the congruency between manufacturing firms' technical capability and customers' technical capability, we performed a two-step cluster analysis, resulting in three clusters (see Table 4). Cluster 1 includes firms that rate their customers' technical capability as well as their own technical capability above the mean. We label this cluster as high/high. Cluster 2 contains firms that evaluate their external technical capability as marginally higher than the mean of all firms, but their own as lower than the mean of all firms (high/low). Cluster 3 represents firms that evaluate their customers' technical capability as well as their technical capability as low (low/low).

Table 4: Clusters for the categories of technical capability

	Mean customer technical capability	Mean firm technical capability	Label
Cluster 1	0.61	0.91	High/high
Cluster 2	0.21	-0.51	High/low
Cluster 3	-1.41	-0.64	Low/low

As our research design includes self-reported data obtained by using one instrument, there is a risk that the results are affected by common method variance. To investigate if this was a potential problem, we performed a single-factor test by using exploratory factor analysis, including all the variables. This strategy resulted in seven factors, each of which had an eigenvalue greater than 1. Moreover, the factor with the greatest loading did not account for a significant percentage of variance (14%), indicating that common method variance is not an issue in this study (Podsakoff et al., 2003). In addition, to estimate the extent of multicollinearity in our data, we evaluated the variance inflation factors, which were well below the threshold value of 10 (Belsley, Kuh and Welsch, 1980). Therefore, it seems that multicollinearity was not an issue in

our study.

Results

The regression analysis results presented in Table 5 show that the analysis supports Hypotheses 1, 2, and 4. More specifically, Model 4 shows that firm technical capability, customer technical capability, and the locus of initiative on the customer side all have a significant effect on knowledge integration ($p>0.001$). Furthermore, when comparing the different models, the explanatory value increases, indicating that the three independent variables have a complementary effect on knowledge integration activities. With respect to the effect of the control variables, the findings show that firm size, turnover, and technological uncertainty have no significant impact, whereas product uncertainty has a negative but non-significant effect on knowledge integration with customers.

Table 5: Regression analysis

	Model 1		*Model 2*		*Model 3*		*Model 4*	
Dep var Knowledge Integration	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Control Variables								
Size_log	.213	.293	.102	.271	-.041	.261	-.255	.244
ROS_log	-.311	.232	-.226	.215	-.091	.207	.070	.194
LowTech vs. MedLowTech	.328	.171	.194	.160	.143	.153	.177	.142
LowTech vs. MedHighTech	.064	.162	.062	.150	.081	.143	.074	.133
LowTech vs. HighTech	.444	.270	.378	.250	.388	.239	.412	.221
Technological Uncertainty	.180*	.077	.205**	.072	.110	.071	.094	.066
Product Uncertainty	.222**	.080	-.012	.083	-.050	.080	-.073	.074
Independent Variables								
Firm's Technical Capability			.420***	.070	.366***	.067	.268***	.065
Customer's Technical Capability					.301***	.065	.235***	.061
Locus of Initiative on the Customer Side							.352***	.060
N	*216*		*216*		*216*		*216*	
F	*14.292****		*36.41****		*21.528****		*34.405****	
Adj. R2	*.134*		*.260*		*.327*		*.421*	
R2	*.162*		*.288*		*355*		*.448*	

Note: *P < 0.05, **P < 0.001, ***P < 0.001

To investigate the extent to which the congruency between firm's and customer's technical capabilities affects knowledge integration (Hypothesis 3), we performed a one-way ANOVA. In particular, we examined whether there was a statistically significant difference among the three clusters of firms in relation to knowledge integration with customers. The results of the one-way ANOVA test (Table 6) revealed that all three clusters were significantly different from each other ($F(2, 213) = 41.844$, $p>0.001$; post-hoc Scheffe test). Firms that have a high degree of technical capability and collaborate with customers that also have high degree of technical capability have a significantly higher degree of knowledge integration with customers (mean=0.597) than firms in Cluster 2 (mean=-0.137) and Cluster 3 (mean=-0.775). Hence, the congruence of high technical capabilities for both the manufacturing firms and customers results in a higher degree of knowledge integration, supporting Hypothesis 3. In addition, Cluster 2 firms report a significantly higher degree of knowledge integration than when both the firm and the customer have a low degree of technical capabilities (Cluster 3).

Table 6: Descriptive statistics of knowledge integration by cluster

Dependent variable: Knowledge Integration	N	Mean	Std. Dev.	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Cluster 1	83	.597	.820	(.090)	.417	.776	-1.30	2.061
Cluster 2	84	-.137	.846	(.092)	-.321	.046	-2.07	2.061
Cluster 3	49	-.775	.908	(.129)	-1.03	-.514	-2.42	.950
Total	216	.000	1.000	(.068)	-.134	.134	-2.42	2.061

Discussion and conclusion

This study aimed to understand the effect of situational factors on knowledge integration with customers in product development projects. Few studies have thus far provided a theoretical foundation for examining the extent to which different factors influence knowledge integration with customers. In addition, existing research tends to adopt a procedural approach to the integration of external knowledge, primarily investigating the mechanisms used to integrate external knowledge (Schmickl and Kieser, 2008; Zirpoli and Camuffo, 2009). Complementing such approaches, our research contributes to the existing knowledge in the field by examining those factors that can enhance organizational procedures and improve the resulting knowledge from the KBV perspective.

To extend previous insights into customer collaboration in innovation activities, we hypothesized that various situational factors play an essential role in knowledge integration. We surveyed the representatives of 216 Swedish manufacturing firms to elucidate the manner in which two specific factors—technical capability and the locus of initiative—influence the contribution of customer knowledge. The empirical results offered support for all four hypotheses.

These findings suggest that technical capability, as embodied by employee knowledge and skills, is a key factor for reacting to emerging technologies (Johnsen and Ford, 2006). However, the technical capability of firms alone is insufficient for facilitating knowledge integration. A

customer's technical capability must also be exploited to improve new product design and production processes (Eslami and Lakemond, 2016). Therefore, we conclude that knowledge integration with customers requires a combination of firms and customers technical capabilities to overcome issues such as design and technical errors throughout the product development process.

In addition, the success of collaborative product development is affected by other factors that contribute to knowledge integration (see also Ritter and Walter, 2003), confirming that initiatives behind customer collaboration can play an important role in the success of knowledge integration. We found that the locus of initiative on the customer side has a strong positive effect on knowledge integration with customers, consistent with the findings reported by Eslami and Lakemond (2016), who suggested that if customers take the initiative, they play an active role and are willing to contribute knowledge in product development projects. Similarly, Brockhoff (2003) suggested that when a customer takes the initiative, collaboration is unsolicited. In this type of collaboration, customers are therefore more willing to provide their inputs about product characteristics, which could be valuable source of information for developers.

In sum, the present study sheds new light on the effect of contingencies on the outcome of knowledge integration. In particular, our findings reveal that while both firms' and customers' technical capabilities are prerequisites for managing customer knowledge in product development, initiative can also be instrumental in increasing the motivation and willingness of both parties to collaborate. Our study also has important implications for managers in charge of customer collaboration. Firms must understand the types of situations in which they can extract the most benefits from knowledge integration with customers. For instance, the most likely situation in which firms integrate knowledge is when they collaborate with technically capable customers and when the initiative of the project is on the customer's side. Further, recognizing these different situations could be more valuable for large firms willing to collaborate with innovative customers to increase their innovation capabilities, as it would allow them to understand in which situations they can integrate knowledge with potential customers.

This study has several limitations. First, it did not include the outcome of the effect of contingency factors on knowledge integration such as degree of innovation (incremental, radical). Future study could thus examine if contingency factors, besides affecting knowledge integration, might also influence firm performance as well as investigate how a series of mechanisms under the influence of different contingency factors could improve product quality and reduce time to market and innovation risk. Second, this study focused on collaborative product development with customers, thereby overlooking relationships with other actors such as business partners and suppliers. Third, the degree of innovation deserves further investigation. Finally, it would be helpful to study the process of knowledge integration not just in relation to product development, but also in other contexts such as service and solution innovation.

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Appendix – Survey questions and items

Approximately how many employees does our company have (answer in integer equivalence)?

- 0-250
- 251-500
- 500-1000
- More than 1000

Approximately how large was the turnover of your company the last fiscal year? (in thousands of kroners)

Which of the following best describes your job title?

How long have you been work in the current company?

Does your company have a formal organisation for research and development R&D? (yes/no)
(if yes) – How many employees work in the R&D department?

Knowledge integration

Please indicate the extent to which you agree with the following on customer interaction in new product development	1 (not at all)-5 (to a great extent)
- Errors and failures are discussed and analyzed with key customers, on all levels - Our employees have the chance to talk with the customers' employees about new ideas, programs and activities that might be of use to the firm - Our employees and customer's employees develop new product development concepts together	

Locus of initiative at customer

Please indicate the degree to which your key customers contribute to the following:	1 (not at all)-5 (to a great extent)
- Key customers present ideas/ suggestions for new product features - Key customer present ideas about new materials, which can be used to produce the product.	

Firm's technical capability

Please indicate your agreement with each of the following statements with respect to your firm's technical capability	1 (not at all)-5 (to a great extent)
- Compared to our competitors, our engineers are proficient with the latest technology - Compared to our competitors, our engineers are skilled at creating technological innovations. - Compared to our competitors, we do incorporate the external technology in our new products. - Compared to our competitors, we do offer a high degree of engineering support to our customers. - Compared to our competitors, we are able to respond quickly to technological changes.	

Customer technical capability

Please indicate your agreement with each of the following statements with respect to your key customer's technical capability	1 (not at all)-5 (to a great extent)
- Compare to their competitors, our key customers are proficient with the latest technology - Compare to their competitors, our key customers are skilled at creating technological innovations - Compare to their competitors, our key customers do contribute with the latest technology in our new products - Compare to their competitors, our key customers do offer a high degree of engineering support to our customers - Compare to their competitors, our ley customers are able to respond quickly to technological changes	

Product uncertainty

Please indicate the extent to which you agree with the following on customer interaction in new product development	1 (not at all)-5 (to a great extent)
- We produce complex products rather than simple products - Our new products have a high degree of innovation - Product development has a high degree of engineering content - Our products are based on technologies that changing fast	

Technological uncertainty

Please indicate your agreement with each of the following statements with respect to technological uncertainty in your industry?	1 (not at all)-5 (to a great extent)
- There is a high level of technological innovation in our industry. - More complex products are provided in our industry. - The technology in our industry is changing rapidly. - Technological changes provide big opportunities in our industry.	

Corporate Responses to the UK Modern Slavery Act

Anthony Flynn and Helen Walker
Cardiff Business School, Cardiff University, Aberconway Building, Colum Drive, Cardiff, Wales, UK, CF10 3EU. Emails: FlynnA2@cardiff.ac.uk; WalkerHL@cardiff.ac.uk
Telephone: +44 (0)2920 874674. Fax: +44 (0)2920 874419

Abstract

The UK Modern Slavery Act 2015 imposes a legal requirement on large firms to publish an annual statement that describes their policies and practices for combating modern slavery. Our research explores how firms are responding to this institutional pressure. We first describe the Act and then explain why institutional theory serves an appropriate theoretical lens for examining firms' responses to it. Next we set out our research methodology, which involves systematic content analysis of anti-slavery statements published by FTSE 350 firms. Provisional results show that there is a high level of compliance with the minimum requirements of the Act.

Keywords: Social; modern slavery; sustainable; operations; supply chain

Introduction

Organisations are under increasing pressure internationally to demonstrate that they are socially responsible in their operations and supply chain management (SCM). This pressure can come from government policy and legislation, but other stakeholders such as shareholders, customers and the media can also influence organisations to act. This increasing attention to socially responsible corporate activity is reflected by a surge in socially sustainable SCM research which has tended to lag behind environmental SCM research (Ashby, Leat and Hudson-Smith, 2012; Miemczyk, Johnsen and Macquet, 2012). Some researchers have sought to investigate how organisations are reporting on their corporate social responsibility and sustainable SCM activities (Lozano and Huisingh, 2011; Tate, Ellram and Kirchoff, 2010; Turker and Altuntas, 2014). In this study we adopt a similar approach by scrutinizing organizational responses to the UK Modern Slavery Act as published on their websites. We investigate organisational responses from an institutional theory perspective (DiMaggio and Powell, 1983). We first introduce the UK Modern Slavery Act below.

The UK Modern Slavery Act 2015

The Modern Slavery Act, which passed into UK law in 2015, represents among the most far-reaching pieces of national legislation yet enacted in the international fight against slavery, servitude, forced labour and human trafficking. It consolidates existing slavery offences into a single Act, strengthens the power of UK law enforcement agencies to investigate and prosecute reported instances of modern slavery, increases the length of sentences for slavery-related crimes and enhances protections for its victims (HM Government, 2015). Since its adoption a number of high profile cases have been successfully prosecuted (Churchill, 2017), which attests to the effectiveness of the Act and the determination of law enforcement agencies to use it in the fight against organised crime.

Modern slavery is a term used to capture two offence categories under the Act (HM Government, 2015, p.18-19). The first offence category is slavery, servitude and forced or compulsory labour. Slavery is "the status or condition of a person over whom all or any of the powers attaching to the right of ownership are exercised". Servitude is "the obligation to provide services that is imposed by the use of coercion". Forced or compulsory labour is "work that is enacted from any person under the menace of any penalty and for which the person has not offered him/her self voluntarily". The second offence category, human trafficking, refers to

"arranging or facilitating the travel of another person with a view to that person being exploited".

As well as establishing new slavery-related offences and issuing sentencing guidelines, the Act addresses slavery in a corporate context. In particular, Section 54 of the Act imposes a legal obligation on all firms with a "demonstrable business presence" in the UK and with turnover in excess of £36 million to report annually on the steps they are taking to prevent against modern slavery in their operations and supply chains (HM Government, 2015). Firms do not have to be domiciled in the UK to come under the remit of the Act. That they are carrying on a business or part of a business in the UK is sufficient. In this way, the Act has extra-territorial reach. The revenue threshold of £36 million means, in effect, that only large firms are legally obliged to prepare and publish a Modern Slavery statement. Less than one per cent of firms operating in the UK are classed as large in size (Office for National Statistics, 2014).

The purpose of Section 54 of the Act is unmistakeably about forcing corporations to be more transparent over their approach to addressing modern slavery. While the Act does not require firms to guarantee that their supply chains are slavery free, it does require them to annually report on the actions they are taking to safeguard against modern slavery. There is both an internal (operations) and external (supply chain) aspect to firms' obligations under the Act. Stakeholders, be they shareholders, employees, investors, regulators, legislators, suppliers, unions, customers, communities or non-governmental organisations (NGOs), get to see what, if anything, the firm is doing to de-risk its operations and supply chains from the effects of modern slavery. Such visibility is intended to create a "race to the top" in supply chain standards (HM Government, 2014, p. 5), as firms seek to satisfy stakeholder expectations and match competitors' actions.

The Act imposes a number of specific reporting obligations on firms. The first of these is to produce a modern slavery statement for each financial year of the organisation. The statement must describe the actions the firm has taken or is in the process of taking to tackle modern slavery. While there is no precise reporting format for Modern Slavery statements, firms are recommended to include information about a number of fields (see Table 1).

Table 1 Main Reporting Fields for Anti-Slavery Statements

Field	Indicative information
Business operations and supply chains	Nature of the firm's business operations and details on its supply chain
Policies	Corporate policies/codes/charters/standards relevant to modern slavery
Risk assessment	Actions that firm undertakes to risk assess its operations and supply chains for modern slavery
Due diligence	Actions that firms undertakes to screen potential suppliers, employees and customers in relation to modern slavery
Risk management	Practices designed to manage the risk of modern slavery in the firm's operations and supply chains
Key Performance Indicators (KPIs)	Metrics relevant to the firm's effectiveness in combating modern slavery
Training	Programmes to inform and train staff and/or business partners on modern slavery issues

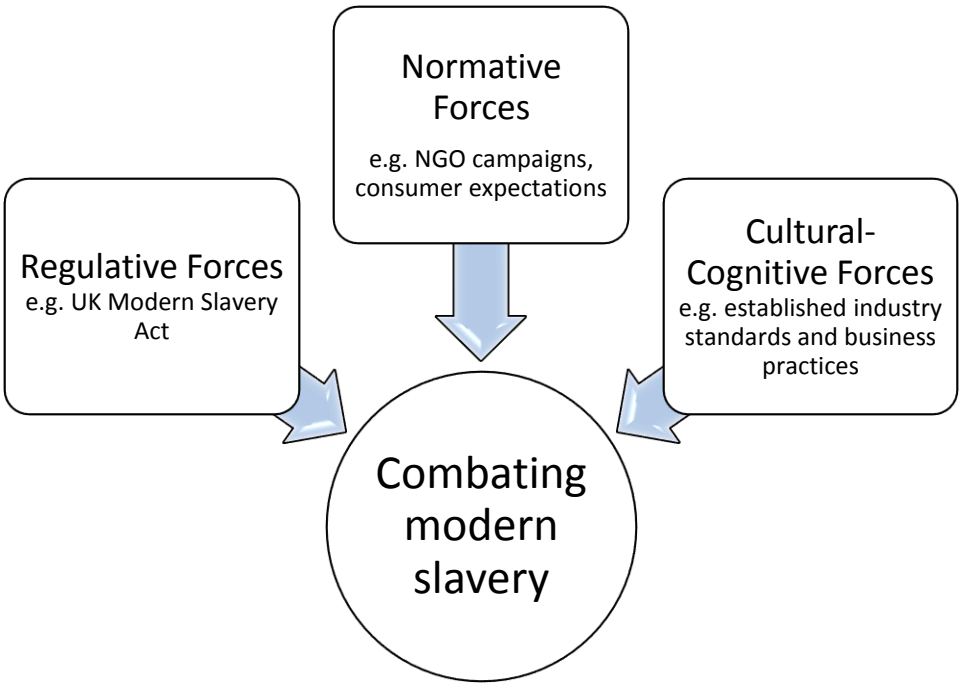
These fields include: business background, policies, risk assessment, due diligence, risk management, key performance indicators (KPIs) and training for staff and/or business partners.

The finalised statement must be formally approved by the board of directors and authorised by a company director or equivalent. Firms are then obliged to publish a link to their statement on the homepage of their website (ibid). This last step is designed to ensure ease of access to the statement, thereby increasing transparency of firms' operations and supply chain practices.

An Institutional Theory Perspective

The Modern Slavery Act represents an institutional pressure bearing on firms. It emanates from the institutional (political) environment, and so constitutes an institutional pressure on the firm as opposed to a competitive or marketplace pressure (Meyer and Rowan, 1977; Scott, 1987). The requirement to publish an annual modern slavery report is imposed on firms from the single most powerful institutional actor in any environment – government. Firms are not publishing modern slavery statements of their own volition. Rather, they are doing so in direct response to a government regulation. They are, as DiMaggio and Powell (1983) describe it, being legally coerced into adopting a new reporting practice. As with many so many aspects of organisational structure and behaviour, it is institutional forces that are determining how firms manage concerns over modern slavery in their operations and supply chains.

Fig. 1 Institutional Pressures for Combating Modern Slavery



Importantly, the Modern Slavery Act is not the only institutional pressure that firms face in relation to ethics and human rights in supply chain management (see Fig.1); nor is it the first. For some time large corporations have been under pressure from NGOs, international bodies such as the UN and wider society to improve standards of employment throughout their supply chains, support fair trade in their country of operations and work to protect the natural environment (Preuss and Brown, 2012; Svensson, 2009). This amounts to a normative institutional pressure on the firm; that is, a pressure that is morally sanctioned rather than legally governed (DiMaggio and Powell, 1983; Scott, 1987). At the same time ideas around corporate social responsibility, stakeholder management and sustainability have entered into mainstream management thinking and education (Ferrell et al., 2013). This equates to a cultural-cognitive pressure on firms as such ideas and beliefs become taken-for-granted across industries (DiMaggio and Powell, 1983).

From an institutional perspective, firms are expected to comply with the requirements of the Modern Slavery Act in order to safeguard their social legitimacy. Not complying with prevailing institutional standards undermines social legitimacy, with potential consequences for the firm in terms of reputational damage, customer dissatisfaction, investor concerns, difficulties in accessing resources and problems securing regulatory approval (Dowling and Pfeffer, 1975). Interestingly, the UK government is alive to this dynamic. In its guidance for firms on how to comply with the Act, it reminds them that modern slavery provisions not only protect workers but also encourage firms to develop a reputation for integrity and social responsibility among their internal and external stakeholders (HM Government, p.4). Conversely, failure to demonstrate compliance "may damage the reputation of the business" (HM Government, p.6).

The power of institutional pressures to determine organisational structure and practices notwithstanding, compliance is not always a given. Depending on the institutional pressure, organisations can exercise a degree of agency and seek to insulate their core operations from external demands (Oliver, 1991). In some cases organisations may seek to avoid or even openly defy prevailing institutional expectations (Oliver, 1991). In other cases organisations may give the appearance of compliance without substantively changing their practices in response to institutional pressures. Meyer and Rowan (1977) labelled this phenomena "ceremonial conformity", by which they meant that institutional conformity can be distinctly ceremonial or symbolic in form. The possibility that firms will engage in a form of ceremonial conformity with the Modern Slavery Act and its reporting requirements cannot be discounted. For whatever reason, they may be unable or unwilling to give full effect to its obligations.

Sustainable SCM studies adopting institutional theory

A number of different studies have adopted an institutional theory perspective to investigate CSR and sustainable SCM (Touboulic and Walker, 2015). Some conceptual papers have adopted institutional theory (as well as others) as the basis for developing sustainable SCM frameworks (Grob and Benn 2014, Varsei et al. 2014, Moxham and Kauppi 2014). The following table summarizes studies adopting an institutional theory perspective to investigate sustainable procurement, purchasing, SCM and practices.

Table 2: Studies adopting an institutional theory perspective on sustainable SCM

Main finding	Countries	Authors
Government influence, institutional mechanisms and senior management commitment minimise barriers to the adoption of sustainable practices.	South Africa	(Dos Santos, Svensson, and Padin 2013)
Applied Institutional Theory to explore the role of supermarkets in the development of legitimate sustainable practices across the dairy supply chains	UK	(Glover et al. 2014)
Develop a framework which explores links between management, measurement and performance through decoupling as articulated by institutional theory	UK	(Grosvold, Hoejmose, and Roehrich 2014)
Employ agency and institutional theory arguments to explore the conditions under which first-tier suppliers will act as agents who fulfil the lead firm's sustainability requirements	Multi	(Wilhelm et al. 2016)
Institutional context affects not only the overall CSR behaviour of the company, but also its institutionalization into a specific function	Germany and Italy	(Ferri et al. 2016)

Sustainable purchasing priorities viewed from institutional perspective, amongst others	US	(Pullman and Wikoff 2017)
Explores the conditions that lead an organization to engage and prioritize sustainable procurement practices, develops model that includes institutional theory	US	(Roman 2017)
Explore the impact of institutional pressures, institutional logics and institutional complexity on sustainable SCM	UK	(Sayed, Hendry, and Bell 2017)
Institutional pressures to adopt sustainable SCM at an industrial park level	China	(Zeng et al. 2017)

It can be seen that institutional theory has proved valuable for understanding the pressures to adopt sustainable SCM. In our study we adopt it to explore an aspect of socially sustainable SCM that to date has received little attention due to the recency of the legislation, that being organisational responses to the UK Modern Slavery Act (2015).

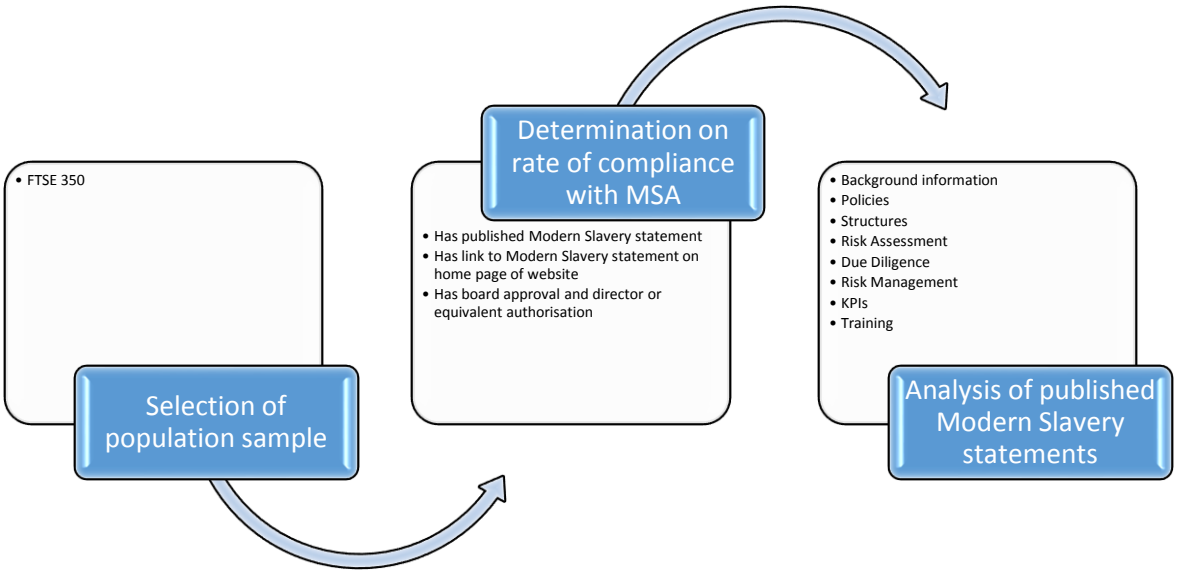
Research Design

Our interest in the Modern Slavery Act is driven by two research questions. These can be stated thus:

> *RQ1: To what extent are firms complying with their legal obligations under the Modern Slavery Act?*
>
> *RQ2: What structures, policies and practices are firms using to combat the risk of modern slavery in their operations and supply chains?*

In seeking to answer the research questions we proceeded as follows (see Fig. 2).

Fig 2. Research Process



First, we identified the FTSE 350 as the most appropriate population sample. The FTSE 350 consists of the 350 largest publicly listed firms on the London Stock Exchange. Second, we examined each firm from the FTSE 350 list against their compliance with the provisions of the Modern Slavery Act. Three sub-questions we asked as part of this process (1) has the firm published a Modern Slavery statement? (2) has the firm created a link on the homepage of their website to their Modern Slavery statement? (3) has the Modern Slavery statement received

board approval and is it signed by a director or equivalent role? Third, we performed a systematic content analysis on all available Modern Slavery statements. This constitutes the most substantial component of the research and was still ongoing at the time of writing this paper. Further information on the development and application of the coding protocol is given in the sub-section below.

Development of coding protocol

Our approach to coding Modern Slavery statements is informed by institutional theory. Institutional theory predicts that firms will adopt particular structures, policies and practices in direct response to regulative, normative and cultural-cognitive pressures. We are interested in discovering what structural features, organisational policies and practices firms have adopted as a result of institutional pressures to combat modern slavery. What does this mean in coding terms? For structural attributes, it means searching for evidence of chains of command for managing anti-slavery, anti-slavery steering committees, working groups, etc. For policies, it means searching for organisational policies/charters/codes linked to slavery and human rights. Moreover, it includes international standards and accords that influence organisational policy e.g. U.N. Declaration of Human Rights, Ethical Trading Principles, etc. For practices, it means identifying actions that firms are taking to mitigate the likelihood of slavery and trafficking in their operations and supply chains.

The coding is proceeding as follows. We started by breaking down the overarching categories of structure, policies and practices into a number of sub-categories. For instance, in relation to anti-slavery practices we sought evidence in the Modern Slavery statements of firms auditing suppliers, imposing contractual obligations on suppliers to adhere to minimum ethical standards, remediating problems in supply chains, terminating relationships with problematic suppliers, etc (see Table 3). To uphold reliability we operationalised each concept. By way of example, imposing contractual obligations on suppliers was operationalised by reference to words/phrases such as "clauses" and "terms and conditions", terminating problematic relationships was operationalised by reference to words/phrases such as "terminate" and "cease working with", etc (see Table 3).

The selection of concepts happened in an iterative fashion. We expected some concepts to feature strongly in the Modern Slavery statements based on our knowledge of industry practices and what previous academic studies have found in respect of structures, policies and practices for promoting ethics in supply chain management. During our initial screening of statements we also observed practices that were appearing with regularity but which we did not anticipate e.g. firms requesting their Tier 1 suppliers to hold Tier 2 suppliers to Modern Slavery Act standards. These unanticipated concepts were subsequently incorporated into our coding protocol. Only when we were satisfied that our protocol was comprehensive did we begin to code in earnest. Our preferred approach was to code by category. Hence, we coded structural attributes relevant to modern slavery first across all 287 statements. When this was complete we proceeded to code policies relevant to modern slavery across all 287 statements, and so on.

Table 3 Coding Protocol

Concept	**Definition**	**Operationalisation [Keywords]**
Practices		
Declaration of Compliance (Suppliers)	Requirement for suppliers and contractors to sign up to or assent to the buyer's code of conduct.	"sign up", "agree in writing", "confirm adherence", "declare compliance", "attest", "certify"

Declaration of Compliance (Employees)	Requirement for managers/employees to sign up to or assent to the company code of conduct.	"sign code", "acknowledge in writing", "commit to", "confirm implementation", "complete assurance process", "certify compliance"
Contractual Obligations	Insertion of anti-slavery clauses, provisions or terms into purchase agreements and supplier contracts.	"clauses", "terms and conditions", "contractual provisions", "framework terms", "legal undertakings", "prohibitions"
Audit	Formal inspection of the organisation's own and/or suppliers' operations through onsite visits, interviews with workers, checking employee records, policy reviews, etc.	"audit", "onsite visit", "onsite assessment", "field-based assessment"
Remediation	Requirement for the organisation and/or its suppliers to take corrective action on ethical issues.	"remediate", "corrective action", "improve conditions", "improvement actions", "work together to develop a plan", "mentoring support"
Termination	Terminate a contract because of sub-standard ethical performance on the part of a supplier, customer or employee.	"terminate contract", "cease trading", "discontinue", "delist", "exit relationships", "deselection", "dismissal", "refuse to partner"
Living Wage Accreditation	Pay workers and/or contract staff at least the UK Living Wage.	"Living Wage"
Inform Suppliers	Inform suppliers of the organisation's updated stance on modern slavery and what it expects from them.	"written to our suppliers", "communicated changes", "informed by letter"
Supplier Own Slavery Policy	Requirement that suppliers have their own anti-slavery policies and procedures in place.	"equivalent policies for slavery", "have own policy and procedures on slavery", "furnish copy of slavery statement"
Supplier Own Annual Slavery Report	Requirement that suppliers prepare an annual slavery and human trafficking report.	"annual slavery report"
Avoidance/Divestment	Not sourcing commodities from a named country/Not investing in a named country.	"Named country"
Certification/Licensing	Supplies that are certified or suppliers that are licensed according to a named industry standard.	"Named initiative"

Review Meetings	Formal meetings to periodically review a supplier's performance.	"review meetings", "meet on a regular basis"
Cascading	Expectation that suppliers implement risk management procedures for their own suppliers and subcontractors.	"cascade", "flow down", "end-to-end responsibility", "one-up", "hold own suppliers to same standards", "third parties to take responsibility for controlling their own supply chain"

Provisional Results

Provisional results indicate that compliance with the provisions of the Modern Slavery Act is high among the FTSE 350 group (see Table 3). The first stipulation of the Act is that firms must publish an annual statement describing activities to combat modern slavery in their operations and supply chains. Over 80 per cent of FTSE 350 firms have published a modern slavery statement. Breaking this down, the largest 100 firms comprising the FTSE 350, known as the FTSE 100, have all published statements bar two. The rate of compliance among the other 250 firms comprising the FTSE 350, known as the FTSE 250 is lower. In their case 76 per cent of firms have published a modern slavery statement. Further analysis revealed that the majority (63 per cent) of FTSE 350 firms that have not published statements are in the Finance and Insurance industry.

The second stipulation of the Act is that firms must create a link on their website homepage to their modern slavery statements. Of the firms with modern slavery statements (n = 287), we found that 79 per cent adhered to this part of the Act. In other words, it was possible to access the firm's modern slavery statement on their home page. For the other 21 per cent of firms, it was necessary to search the company's internal library of documents and reports to locate the statement. Doing so goes against the intention of the Act, which is to increase visibility on how firms are managing modern slavery risks. It also means that the opportunity to signal to stakeholders that the firm is committed to preventing modern slavery is being lost. Again, FTSE 100 firms exhibited higher compliance than FTSE 250 firms.

The third stipulation of the Act concerns board approval and director authorisation. Here approximately 90 per cent of firms under consideration (n = 287) have ensured that their statements have been signed off by a director or a senior manager. This is important as it signals that modern slavery is on the radar of the board of directors and senior management. Moreover, by signing off modern slavery statements directors and senior management are taking ultimate responsibility for this business risk.

Table 4 Compliance with Modern Slavery Act

Compliance Aspect	**FTSE 100**	**FTSE 250**	**FTSE 350 (Total)**	**n**
Published Modern Slavery statement	98%	78.1%	83.9%	342
Link on website home page to Modern Slavery statement	84.7%	76.2%	79.1%	287
Signed off by director or executive	92.9%	89.4%	90.6%	287

Research Contribution

This paper has empirical and theoretical contributions to make. Empirically, it aims to provide among the first evidence on how firms are responding to the Modern Slavery Act. This evidence

will complement the existing body of knowledge on ethical, sustainable supply chain management (e.g. Tate et al., 2010; Walker and Jones, 2012). Our preliminary results show that compliance with the Act has been strong to date, although the FTSE 250 cohort is currently lagging the larger FTSE 100 cohort. We are currently analysing the contents of the modern slavery statements, and will make this data available in the near future. Theoretically, our research applies institutional theory to a new context; that of legislative efforts to force large firms to report on and take responsibility for modern slavery in their operations and supply chains.

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Supply market orientation as a sensing and responding capability in purchasing and supply management: A dynamic capabilities view

Kai Foerstl[1], Anni-Kaisa Kähkönen[2] and Constantin Blome[3]
1 German Graduate School of Management & Law, Germany
2 Lappeenranta University of Technology, Finland
3 University of Sussex, United Kingdom

Abstract
We conceptualize the concept of supply market orientation (SMO), discuss how it is developed and how it differs within and across firms based on multiple case studies. By elaborating the dynamic capabilities view to the SMO phenomenon, we combine empirical evidence with theoretical reasoning in its establishment as a dynamic capability. Firms that exploit supply market intelligence to assess, integrate, and reconfigure their resources in a timely and rigorous manner are projected to be more successful than those who not. However, reactive vs. proactive SMO application is contingent upon firm-level and purchasing category-level characteristics.

Keywords: Purchasing integration, Supply market orientation, Case studies

Introduction

Rising global trade and competition, demand for increased product variety, shorter product life cycles, and rapid technological change are expected to intensify in the future (Bozarth et al., 2009; Mitchell et al., 2011). In this regard, firms that are better equipped to cope with market developments and to anticipate changing conditions are expected to reap superior profitability and competitive advantage (Day, 1994). Thus, the concept of market orientation has attracted broad attention among practitioners and scholars alike. Essentially, market orientation is reflected in the activities and behaviors associated with the firm-wide generation, dissemination and responsiveness to market intelligence pertaining to current and future customer needs (Kohli & Jaworski, 1990).The strong customer focus underlying the market orientation concept has resulted in research emphasis on downstream markets. However, increased levels of outsourcing, raw materials scarcity, political and technological turbulence, and intensified competition also require firms to approach their upstream markets strategically (Kraljic, 1983; Krause et al., 2001; Liao et al., 2010). Neglecting such markets could result in the misalignment of supply and demand, compromising operational performance and risk mitigation (Handfield, 2010). As purchased goods and services typically range between 50% and 80% of the costs of goods sold for manufacturers (Johnson et al., 2011), even incremental improvements to purchasing and supply management processes impact firms' bottom-line (Azadegan et al., 2013). Moreover, firms seek supplier capabilities in engineering, design, manufacturing, and delivery (Narasimhan & Das, 2001; Petersen et al., 2005), and count on suppliers as sources of innovation (Calantone & Stanko, 2007). As a result, some suppliers also impact a buying firms' top-line performance (Zimmermann & Foerstl, 2014). For instance suppliers of semi-conductors have become an important source of innovation in passenger cars, but these suppliers cannot be considered direct suppliers to the lager automotive OEMs. Hence, companies such as BMW have developed supplier technology scouting processes to potentially integrate these seemingly unimportant, in terms of spend volume, and distant suppliers in ongoing product innovation projects.

Only a few scholars have examined market orientation in the upstream supply context. Handfield (2010) was one of the first scholars to directly address supply markets in an explo-

ration of supply market intelligence. Further steps toward an understanding of supply market orientation have been taken by research on supply chain orientation (Fawcett et al., 2007; Ellinger et al., 2012). In spite of a range of concepts addressing the challenges of direct supplier portfolio management (Kraljic, 1983) our understanding how buying firms create transparency and intelligence about the entire upstream supply network, including distant suppliers, is limited. In particular, the active management of nexus suppliers and other key lower-tier suppliers must be enabled through supply market intelligence (Yan et al., 2015). In fact, little is known about what this concept actually constitutes, how it is developed, and how it differs across buying firms and how it differs in its application across purchasing categories. Thus, we pose the following research question: *How do buying firms develop and configure sensing and responding capabilities through supply market orientation and how do they differ within and across firms?*

To answer to the question we conducted multiple case studies with embedded multiple units of analysis (Corbin & Strauss, 1990; Yin, 2009). Thereby, we first establish the theoretical background for our exploration based on the information and knowledge management literature in purchasing and supply management. As a theoretical backbone we elaborate concepts of absorptive and desorptive capacity as well as dynamic capabilities (DCV), which all stem from the family of resource-based theories. Next, we draw from the five case studies to explicate a concept and definition of supply market orientation. Reflecting our findings against the literature we elaborate on its value capture potential based on various contextual antecedents that drive its application at the purchasing category level We conclude by stating the contributions we have made to business practice and theory, and by discussing a number of promising avenues for future research.

Theoretical background

Supply market intelligence and knowledge

Assessing the purchase situation in terms of the importance of purchasing (e.g., cost of materials to total costs, value-added profile, profitability profile) and the complexity of the supply market (e.g., supply scarcity, competitive environment, pace of technological change), firms can determine the type of supply strategy required to minimize supply vulnerabilities and to exploit their potential buying power (Kraljic, 1983). However, the purchasing portfolio approach and other related frameworks are rather static and neglect the need for continuous updating of information to ensure fitting strategic choice over time as the supply environment evolves. Recently, for instance, Akhavan and Beckmann (2017) found that proactive, opportunity-oriented strategies, where suppliers and their capabilities are developed, are able to respond more effectively to the changing requirements than traditional reactive strategies. In order not only to react to upcoming information, but to proactively update information and be ahead of competition, firm-level capabilities in developing supply market intelligence and knowledge are needed. Supply market intelligence can be defined as "a process for creating competitive advantage and reducing risks through increased knowledge of supply market dynamics and supply base composition" (Handfield, 2010, p. 43-44).

Traditionally, research focusing on knowledge and knowledge-based capabilities lays its foundation on knowledge-based view of a firm (KBV). KBV sees knowledge as the most important strategic resource of a firm building the resource-based view of a firm (RBV) (Grant, 1996). RBV explains how firms create competitive advantage by accumulating and exploiting resources that are rare, valuable, non-substitutable, and difficult to imitate (Rumelt, 1984; Wernerfelt, 1984; Barney, 1991). In the purchasing and supply management arena KBV has been applied with a focus in the creation and transfer of knowledge (Blome et al., 2014), through collaboration (Zacharia et al., 2011) and its impact on firm as well as supply chain performance (Hult et al., 2006; Kristal et al., 2010).

Firm's ability to sense information concerning the business environment, turn it into

knowledge and to respond through reconfiguration of resources and capabilities is also referred to as absorptive capacity (AC). According to Cohen and Levinthal (1990, p. 128), absorptive capacity refers to "the ability of a firm to recognize the value of new external information, assimilate it and apply it to commercial end". The basic premise is that prior related knowledge is needed to assimilate and to use new knowledge. AC depends on the links between individual capabilities and can be strengthened if a firm develops a broad network of internal and external relationships (Cohen & Levinthal, 1990). In the supply management literature, AC is combined especially with buyer-supplier relationships and networks (Narasimhan & Narayanan, 2013; Sáenz et al., 2014), performance (Azadegan, 2011; Dobrzykowski et al., 2015), innovativeness (Azadegan et al., 2008; Azadegan, 2011), and value creation (Sáenz et al., 2014) but lately also with sustainable sourcing practices (Meinlschmidt et al., 2016). Kim et al. (2015) studied the concept of relative absorptive capacity in buyer-driven knowledge transfer. Azadegan et al. (2008) utilized the knowledge-based view whereas it is increasingly theorized as a dynamic capability (Sáenz et al., 2014; Volberda et al., 2010).

In addition to the absorption of knowledge also the desorption has recently been received close attention (Meinlschmidt et al., 2016; Roldán Bravo et al., 2016). The interplay of absorptive and desorptive capacity is at the core of a supply market orientation capability. Hence, the continuous calls for proactive and faster responses to supply market dynamics require more than the ability to sense assimilate and apply external information. Successful firms redeploy internal and external resources and capabilities through internal coordination and integration in their pursuit to capture value creation opportunities (Hodgkinson et al., 2012; Najafi-Tavani et al., 2016) and to attain temporal congruence with the external environment (Teece et al., 1997). Essentially, such dynamic capabilities are defined as "the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments" (Teece et al., 1997, p. 516). Hence, specific processes or routines enable the combination, transformation, or renewal of the resource stock of firms into new operational processes and capabilities as markets evolve (Eisenhardt & Martin, 2000). By conceptualizing supply market orientation as such a dynamic capability, we assume an indirect link between supply market orientation and buying firm operational and financial performance (Zott, 2003; Barreto, 2010).

Market orientation in the upstream supply context

Essentially, market orientation refers to the implementation of the marketing concept. It is reflected in the diverse activities and behaviors associated with firm-wide generation, dissemination, and responsiveness to market intelligence (Kohli & Jaworski, 1990). Thereby, market intelligence embraces current and future customer needs and preferences as well as the exogenous forces (e.g., competition, technology, culture) affecting them (Jaworski & Kohli, 1993; Matsuno et al., 2000). Rooted in marketing research and practice, the market orientation concept fundamentally embraces the notion of customer focus (Kohli & Jaworski, 1990). For a comprehensive overview of the market orientation literature, we refer to Liao et al. (2011).

Few scholars have examined market orientation in the supply context. Fugate et al. (2008) emphasized the role of logistics in market orientation. Zhao and Cavusgil (2006) reported a link between suppliers' market orientation and manufacturers' trust, which in turn affects manufacturers' long-term orientation toward suppliers. Min et al. (2007) argued that market orientation drives a systems approach to consider the supply chain as a source of resources and skills, thus promoting collaborative initiatives. However, these research efforts do not explicitly take supply market peculiarities as contextual antecedents for the application of a supply market orientation capability into consideration.

The market orientation concept has influenced the domains of demand chain management (Chen et al., 2004; Jüttner et al., 2010) and supply chain segmentation (Christopher & Towill, 2002). Moreover, a step toward understanding supply market orientation has been

taken by research on supply chain orientation, which emphasizes a supply chain philosophy in the firm (e.g., Mentzer et al., 2001; Ellinger et al., 2012) and the corresponding need to manage the capacity and capabilities of suppliers to improve productivity, quality, and innovation (e.g., Lee, 2004; Fawcett et al., 2007; Ireland & Webb, 2007).

Another step towards an understanding of supply market orientation was taken by Handfield (2010), who explored a concept of supply market intelligence. However, the concept essentially mirrors the existing concept of market orientation with regard to its basic information processing aspects of market intelligence generation and dissemination. Little is yet known about how firms use supply market intelligence and what this implicates organizationally at the functional and the purchasing category level. Moreover, market intelligence is just the starting point of a market orientation (Kohli & Jaworski, 1990), which becomes ever more important for the successful seizure the established sourcing practices such as supplier evaluation and selection, supplier development, supplier certification, supply base optimization, and strategic supplier relationship management (Narasimhan & Das, 2001; Choi & Krause, 2006).

Case study methodology

Rationale and sampling

Even though existing research has provided a number of ideas on what supply market orientation could entail it was not yet clear what actually constitutes supply market orientation, how it is developed, how it differs within and across firms, and which contextual factors can explain such differences. Following our research question, we sought to explore the focal phenomenon in the context in which it occurs (Meredith, 1998), while being able to embrace existing findings and theory for a substantiation of our results (Eisenhardt, 1989; Yin, 2009). In this regard, our research approach can best be described as theory elaboration (Vaughan, 1992). In particular, we applied a qualitative, inductive research design comprising multiple case studies with embedded multiple units of analysis (Eisenhardt, 1989; Yin, 2009). This approach allowed us to identify and explore relevant constructs and interrelationships, adding description and understanding of the interactions, meanings, and processes that constitute real-life settings (Gephart, 2004). In doing so, we extended the DCV to the realm of our study, providing a theoretical rationale for our empirically derived concept and research propositions.

In selecting cases, we followed a theoretical sampling logic that allowed us to replicate and extend findings and theory by exploring and understanding important categories, properties, and interrelationships (Meredith, 1998). Thereby, cases were chosen for their potential to illuminate and extend relationships and logic among constructs, that is, for their potential contribution to theory development within the set of cases (Glaser & Strauss, 1967; Eisenhardt, 1989; Eisenhardt & Graebner, 2007). Thus, cases allowed for relational inference (Meredith, 1998) rather than representational inference from a random sample from a population (Flyvbjerg, 2006).

We restricted our initial population to large firms (turnover > $5 billion; employees > 15,000) with a large multinational supply base (suppliers > 25,000), thus constraining variation due to size differences and regional idiosyncrasies. We presumed that such large firms have an overall greater need and resource endowment towards a supply market orientation. For reasons of external validity, we deliberately attempted to build a theoretical sample comprising firms operating in different businesses, mainly manufacturing, services, and a hybrid of these two (Allred et al., 2011).

Moreover, we required variation regarding supposedly relevant contextual factors at the firm and the purchasing category level (e.g., Kraljic, 1983). Thus, our main observational unit of analysis is the firm, whereas the major purchase categories of the firm serve as an explanatory sub-unit of analysis (Wilhelm, 2011).

We first selected a manufacturing firm (ALPHA) and a service firm (ECHO), each with a

supposedly heterogeneous supply environment in terms of different purchase categories. Based on emergent findings from the first two cases, we selected incremental cases to facilitate the replication and extension of findings and theory (Eisenhardt, 1989; Yin, 2009). Thus, our sampling strategy shifted from typical cases (ALPHA, ECHO) to diverse cases (BRAVO, CHARLIE, DELTA) (Seawright & Gerring, 2008; Pratt, 2009) for a more sophisticated understanding of differences in the nature of supply market orientation and related interdependencies. Table 1 characterizes our final sample comprising the five firms.

Table 1. Sample Characteristics.

	Industry	Turnover	# Employees	#Informants	#Interviews	Functional areas involved in interview process (no exact job titles; possibly more than one informant from the same functional area)
ALPHA	Manufacturing	> $50 bn	> 100,000	10	12	Purchasing (strategy, controlling, market intelligence, category management) Liaison functions (procurement engineering, commodity engineering) Other technical functions (quality, R&D)
BRAVO	Manufacturing and services	> $50 bn	> 100,000	6	7	Purchasing (strategy, project purchasing) Liaison functions (cost engineering) Other commercial functions (customer projects) Other technical functions (engineering, R&D)
CHARLIE	Manufacturing	< $10 bn	< 50,000	8	8	Purchasing (strategy / processes, controlling, category management) Other commercial functions (marketing, sales) Other technical functions (engineering)
DELTA	Services	> $50 bn	> 100,000	8	8	Purchasing (strategy, category management) Liaison functions (procurement engineering) Other commercial functions (marketing strategy, marketing operations) Other technical functions (engineering, product innovations)
ECHO	Services	$10-50 bn	50,000-100,000	8	8	Purchasing (CPO, subunit CPO, strategy, controlling, communications) Other commercial functions (sales)

Data collection and selection of informants

To investigate the focal phenomena from different angles, tapping into a wide range of individual experiences and perspectives, we used numerous informants (Jick, 1979; Stuart et al., 2002; Eisenhardt & Graebner, 2007). We first approached purchasing managers since the purchasing function is usually the major interface to firms' upstream supply chains. Also, the inclusion of purchasing managers allowed us to better gauge supplier relationships (Frohlich & Westbrook, 2001) and integration with other internal functions. We then approached additional informants in liaison, commercial or technical non-purchasing positions. An illustration of our data collection and informant selection is provided in Table 1.

Data collection comprised in-depth interviews with informants to gain understanding of the phenomena (Pratt, 2009), including the meanings ascribed by informants to actions and settings (Gephart, 2004). We developed semi-structured interview protocols with open-ended questions to enable managers to describe events and processes, to facilitate comparability of findings, and to retain the flexibility to probe deeper into emergent themes by eliciting examples, illustrations, and other insights (Kohli & Jaworski, 1990; Fawcett et al., 2012). The interviews lasted 45 to 90 minutes and were added until we reached theoretical saturation (Glaser & Strauss, 1967; Eisenhardt, 1989).

We conducted between seven and twelve interviews per firm. All interviews were transcribed as a basis for coding analysis according to Strauss and Corbin (1998), resulting approximately 700 pages of interview transcripts in total. Out of the total of 40 informants, 28 held purchasing positions, seven held marketing and sales positions, and five held quality, engineering, or R&D positions. The initial interviews conducted at each firm were supple-

mented with a questionnaire to complement and challenge interview responses. Furthermore, we collected secondary data in the form of publicly available documents (e.g., annual reports) and internal firm documents (e.g., guidelines, process documentation, performance reports).

Data analysis

We first conducted a within-case analysis, generating single case representations in the form of detailed, descriptive write-ups (Ellram, 1996; Barratt et al., 2011). Within-case analysis results were then used as a basis for cross-case synthesis, which involved identifying, comparing, and contrasting patterns across cases in search of similarities and differences among cases and groups of cases (Eisenhardt, 1989; Yin, 2009). In doing so, we added order to the emergent conceptualization of supply market orientation by explicitly delineating patterns, thereby introducing causality (Whetten, 1989).

A manual coding process was used to reflect the diverse and nuanced answers as well as the linguistic and firm-related variety of informants' language (Fawcett et al., 2012). First, we derived first-order codes and provisional codes (Pratt, 2009) by following open coding procedures (Strauss & Corbin, 1998). Data and emergent results were then used together with the literature to derive second-order codes and to enfold theory (Pratt, 2009) by using axial and selective coding procedures (Strauss & Corbin, 1998). Thereby, we consolidated specific, but related codes into broader, more theoretical categories (Strauss & Corbin, 1998).

Results: Supply market orientation across cases

In the following section, we develop a definition of supply market orientation and discuss the concept and its elements. In doing so, we mainly build on our empirical case study observations while simultaneously reflecting the theoretical DCV perspective to underpin our results.

An empirically derived definition of a supply market orientation capability

As a basis for the following discussion, Table 2 integrates detailed information about the practices observed at our cases in generating, disseminating, and using supply market intelligence, thereby indicating differences and similarities within and across firms.

Our cases demonstrate that supply market intelligence comprises more than day-to-day information exchange between firms and their suppliers. Rather, supply market intelligence embraces multiple tiers of the upstream supply chain and the exogenous forces affecting them (e.g., regulation, technology, competition). Examples include analyses of suppliers' supply cost structures (ALPHA, BRAVO), supplier peer group analyses (DELTA), workshops with both complementary and competing part suppliers to create new technologyy ideas (ALPHA), and analyses of competitors' supply cost structures as a basis for benchmarking (ALPHA). Together with external financial analysts, DELTA conducts extensive financial supplier risk assessments. CHARLIE evaluates key commodity markets (e.g., crude oil) of relevance to its directly sourced raw materials. BRAVO and DELTA do not directly source raw materials, but analyze related markets along with internal and suppliers' cost structures to determine price trends for sourced parts and products. A purchasing executive at BRAVO stated: *"Of course, in the sense of market intelligence, we know very well how [raw material] prices develop. […] If there is a 30% rise in copper prices, we can tell quite well what that means for the final product. For this, we made assessments […] to determine the copper content […] in our [sourced and final] products."*

Moreover, supply market intelligence embraces not only current suppliers and supply markets, but also potential suppliers and supply markets. This pertains, for example, to technology and innovation screening (ALPHA, BRAVO, DELTA). ALPHA recently collaborated with a consultancy firm to evaluate supply market structures and potential suppliers for plastic parts in China. A global purchasing analysis team at BRAVO evaluates opportunities and risks in potential supply markets, including market structure and supplier analyses along with macro-economic analyses. CHARLIE evaluates opportunities and risks in raw material mar-

kets as part of its extensive supply risk management. DELTA and ECHO evaluate suppliers' technical capabilities together with product and service trends to improve their own product and service portfolios.

Table 2. Case Analysis Display Supply Market Intelligence Generation, Dissemination, and Use

	Supply market intelligence generation	Supply market intelligence dissemination	Supply market intelligence use
ALPHA	***Intra-functional (purchasing central):*** Macroeconomics, firm-wide markets/suppliers (e.g. raw material markets), competitors (e.g. global sourcing/cost structures) ***Intra-functional (purchasing local):*** Specific/ad-hoc analyses (e.g. regional markets/suppliers), bundling potentials, cost benchmarking, technology screening ***Cross-functional (commodity / procurement engineering):*** Technical market/supplier analyses (e.g. cost structures, processes, quality), technology/innovation scouting, joint analyses with suppliers (e.g. process optimization/innovation workshops) ***External (market researchers / consulting):*** Macroeconomics, raw material/commodity markets (e.g. price indices), specific ad-hoc analyses (e.g. plastics markets in China)	***Intra-functional (purchasing central and local):*** (De-)centralized regular and ad-hoc collection/dissemination ***Cross-functional:*** Meetings/discussions (e.g. strategy review, technology council) Teams (e.g. material strategy teams: purchasing, R&D, quality) Processes (e.g. quality monitoring/management, contract design) Projects (e.g. product lifecycle management, cost optimization) Liaison functions (commodity/procurement engineering) Ad-hoc to technical functions such as R&D and quality (e.g. technology/innovation roadmaps, preferred suppliers/materials) Very little active ad-hoc to sales (e.g. preferred suppliers)	***Intra-functional (purchasing central and local):*** Strategy formulation (e.g. supply base development, global sourcing, cost optimization, technology roadmaps), risk management (e.g. currency/commodity hedging, availability / quality assurance), negotiation, supplier management and development, target setting, performance evaluation, budgeting, reporting ***Cross-functional:*** Strategy formulation (e.g. outsourcing initiatives, cost analyses in business strategy, technical supplier analyses in strategies of R&D/quality), product lifecycle management, value engineering, product development, budgeting, planning (price, quality, capacity), reporting
BRAVO	***Intra-functional (purchasing central):*** Macroeconomics, supply base (e.g. competitive/cost structure, wages, skill levels), market potentials and risks, early indicators ***Intra-functional (purchasing local):*** Specific/ad-hoc analyses (e.g. regional markets/suppliers with respect to quality, technology, opportunities and risks) ***Cross-functional (cost engineering):*** Technical market/supplier analyses (e.g. cost structures, processes), supplier benchmarks (incl. competitors), technical support of specific/ad-hoc analyses (e.g. market opportunities/risks) ***External (market researchers):*** Macroeconomics, raw material/commodity markets	***Intra-functional (purchasing central and local):*** (De-)centralized regular and ad-hoc collection/dissemination ***Cross-functional:*** Regular standard analyses (e.g. price, availability) Ad-hoc analyses (e.g. new market evaluations/potentials/risks) *In-house development / manufacturing context:* Projects (active/on-demand) / little active ad-hoc dissemination Liaison functions (cost engineering) *Customer service / integrated solutions context:* Projects (on-demand) / very little active ad-hoc dissemination	***Intra-functional (purchasing central and local):*** Strategy formulation (e.g. supply base development, cost reduction roadmaps with key suppliers), risk management (existing and new markets), product cost structure analyses, price benchmarks, negotiation, supplier management and development, target setting, performance evaluation, budgeting, reporting ***Cross-functional:*** Projects (e.g. supplier selection, evaluation, development), sourced innovation and utilization of suppliers' technical capabilities in the context of in-house product/service development, planning
CHARLIE	***Intra-functional (purchasing central):*** Macroeconomics, broad market/supply base analyses ***Intra-functional (purchasing local):*** Specific/ad-hoc analyses (e.g.regional markets/suppliers with respect to price, delivery, quality, technology), regular/ad-hoc raw material market analyses (e.g. market overview/potentials/risks, competitor benchmarks, price forecasts/variance analyses) ***External (market researchers):*** Macroeconomics, raw material/commodity markets (e.g. crude oil, steel, plastics) to complement extensive internal efforts	***Intra-functional (purchasing central and local):*** (De-)centralized regular and ad-hoc collection/dissemination ***Cross-functional:*** Regular IT-based dissemination of raw material analyses/reports Limited additional active dissemination to marketing and sales (e.g. ad-hoc analyses in case of unforeseen events/crises) Meetings (e.g. budgeting, strategy, pricing/engineering councils) Projects in technical equipment and machinery (largely commercial analyses by purchasing on-demand of other functions)	***Intra-functional (purchasing central and local):*** Strategy formulation (e.g. raw material strategies), risk management, negotiation, supplier management and development (technical equipment and machinery), target setting, performance evaluation, reporting ***Cross-functional:*** Strategy formulation (e.g. business unit strategies based on raw material/product structure analyses), negotiation support for sales (raw material analyses), customer contract design (price escalation clauses)
DELTA	***Intra-functional (purchasing central):*** Macroeconomics, broad market supply base analyses, competitors (incl. peer groups), suppliers (e.g. market shares, financials), raw material/commodity labor markets, product trends ***Intra-functional (purchasing local):*** Specific/ad-hoc analyses (e.g. regional markets/suppliers, detailed analyses of price/product developments and trends) ***Cross-functional (procurement engineering):*** Technical supplier analyses (e.g. cost structures/processes) ***External (market researchers / financial analysts):*** Financials (Bloomberg), specialized market research platforms	***Intra-functional (purchasing central and local):*** (De-)centralized regular and ad-hoc collection/dissemination ***Cross-functional:*** Supply market reports (developments/trends in major categories) Supplier books (consolidated intelligence on strategic suppliers) Meetings (e.g. budgeting, planning, strategy) Liaison functions (procurement engineering) Projects (mostly on-demand, for example firm-wide cost optimization projects, mobile/fixed line network construction projects)	***Intra-functional (purchasing central and local):*** Strategy formulation (e.g. supply base development), cost/price benchmarking, risk management (operational/financial), negotiation, supplier management and development, budgeting, target setting, reporting ***Cross-functional:*** Cost-benefit analyses, business case calculation (cost/price aspects), supplier evaluation and selection, technical cost optimization initiatives, product/service portfolio management, strategic firm-wide cost optimization projects, budgeting, planning
ECHO	***Intra-functional (purchasing central):*** Macroeconomics (very limited), few broad market analyses ***Intra-functional (purchasing local):*** Specific/ad-hoc analyses (e.g. regional markets/suppliers), product / service innovations/technology trends (limited scope) ***External (market researchers):*** Macroeconomics, standard raw material/commodity markets (e.g. steel, copper, wood, plastics, crude oil, fuel)	***Intra-functional (purchasing central and local):*** Little centralized collection/dissemination (broad overviews) Ad-hoc dissemination at subgroup level (diverse efforts) ***Cross-functional:*** Meetings (e.g. status/market reports delivered by purchasing) Ad-hoc management reports (e.g. board, subgroup management) Projects (largely restricted to standard issues: price, availability)	***Intra-functional (purchasing central and local):*** Strategy formulation (e.g. supply base development, spend / category management, insourcing), risk management, basic supplier management and development ***Cross-functional:*** Business case calculation, quotation costing, tender preparation, supplier evaluation/selection, reciprocal business deals (suppliers' portfolio/earning power)

Our case observations show that the purchasing function plays a critical role in the generation and, in particular, the dissemination of supply market intelligence, due to its strong interface to supply markets and its boundary-spanning role inside the buying firm. This is reflected in the statement by a senior purchasing executive at ECHO: *"People identify us [purchasing] as an information pool in any situation. We are often the contact persons for all sorts of things. […] Through the permanent dialog, we are always some kind of catalyst: we pass on information, place it appropriately, establish contacts, communicate, facilitate… that's also part of our job."*

However, supply market intelligence is not the sole responsibility of the purchasing function. In fact, its highly interdisciplinary nature (e.g., macroeconomic, technical, and financial analyses) requires integration with other functions, including liaison functions. Even though the case firms differ in their specific efforts, most of them use supply market intelligence in strategy formulation, risk management, supplier management, and performance management. Thereby, firms develop abilities to create valuable knowledge emanating from the dispersed and specialist supply market intelligence and to beneficially embed this knowledge into practices, processes, and organizational routines. Here, we refer to knowledge as information and know-how (Kogut and Zander, 1992), which includes, for instance, market research know-how (ALPHA, BRAVO, CHARLIE), forecasting know-how (ALPHA, CHARLIE), and cost and process analysis know-how (BRAVO).

Our observations suggest that exploiting supply market intelligence allows firms to project whether certain resources (or combinations thereof) will be more or less beneficial. Resource complementarities can provide advantages in that multiplicative effects surpass the gains from deploying resources individually (Siggelkow, 2002; Das et al., 2006). At ALPHA and CHARLIE, exploiting supply market intelligence improves supply risk management and enables fast and flexible response to supply market changes. Exploiting supply market intelligence improves supplier management, strategy formulation, quality management, and the development of new products at ALPHA, BRAVO, and DELTA. At ALPHA, it also enables the timely development of alternative technologies and new suppliers. Thus, exploiting supply market intelligence enables firms to deploy their resources in purchasing and supply management more effectively.

The DCV provides valuable insight into the capability development process (Eisenhardt & Martin, 2000). Specifically, the DCV provides understanding of the process by which firms transform the dispersed resources available in purchasing and supply management into the distinctive capability of supply market orientation. Thereby, supply market orientation can be disaggregated into the capacity to sense opportunities and threats through supply market intelligence, and to exploit this intelligence to seize opportunities and to enhance, combine, and reconfigure available resources in purchasing and supply management (Teece, 2007). A similar notion has been put forward by Menguc and Auh (2006), who suggested that a customer market orientation is transformed into a dynamic capability when complemented by reconfigurational capabilities. Moreover, scholars have attributed an important role to learning mechanisms in the development of dynamic capabilities (Zollo & Winter, 2002), thus emphasizing the role of knowledge in the conceptualization of supply market orientation.

Based on our case firm observations and our theoretical arguments, we are now able to articulate the following definition of supply market orientation: *Supply market orientation refers to the capability of a firm to exploit supply market intelligence to assess, integrate, and reconfigure the heterogeneously dispersed resources in purchasing and supply management in a way that best reflects the peculiarities of the firm's supply environment.*

This definition recognizes the concept of supply market intelligence and thus reflects the basic information procedural aspects of extant conceptualizations of market orientation. However, it explicitly addresses the beneficial exploitation of supply market intelligence. Second, the definition recognizes the diverse practices in purchasing and supply management that

have been adopted individually by firms to tackle the challenges of their particular supply environment. However, dynamic and responsive markets require firms to manage their upstream supply chain more strategically (Liao et al., 2010). Thus, our definition builds on the DCV to incorporate the notion that firms not only accumulate dispersed information and knowledge as resources, but rather assess, integrate, and reconfigure internal resources as a result of the generated intelligence in a way that best fits their supply environment.

Elements of supply market orientation

Our cases provide evidence for the existence of different elements of supply market orientation, which is in line with research suggesting that dynamic capabilities exhibit common features, but are idiosyncratic in their details (Eisenhardt & Martin, 2000). First, the elements of supply market orientation can differ with regard to their organizational level. While firm-level elements span different purchase categories, category-level elements are specific to a certain purchase category. Category-level elements comprise, for instance, efforts of individual category managers to conduct specific analyses of materials, parts, and suppliers. Firm-level elements comprise, for example, a corporate supply market intelligence department at ALPHA, a global purchasing analysis team at BRAVO, a market research team in purchasing strategy at DELTA, as well as category-spanning market intelligence generation and dissemination processes. As individual category managers' efforts are inevitably limited in scope and sophistication, such firm-level elements of supply market orientation are of utmost importance to complement category-level efforts.

The elements of supply market orientation can furthermore differ with regard to their temporal focus. Reactive elements reflect a defensive stance, and are often related to specific customer market-related demands by internal stakeholders. A category manager at CHARLIE noted as follows: *"When a business unit would like to advance a new product […], then it's our task to evaluate: Which are the right raw material sources? Where are they? Which [raw material] specifications are necessary to arrive at the final product?"* A customer service manager at BRAVO critically appraised the reactive element: *"The information may be available, or may be obtainable, but it's not push information. […] Purchasing does not provide quarterly overviews, for example of certain markets. […] If we have a specific project, or a potential customer, or if we have entered the tendering stage, and we place specific requests, then purchasing is absolutely capable of delivering the information. But it's not delivered proactively."* This process is illustrated in the bottom part of Figure 1.

On the other hand, proactive elements reflect a preventive stance and an endeavor to delve into uncharted territory. As such, they often relate to risk and innovation, with the aim of proactively pushing supply market opportunities and risks into the firm. Hence, supply market intelligence is generated in anticipation of its value, as opposed to the reactive case (top part of Figure 1). A purchasing manager at CHARLIE remarked: *"Through market intelligence, that is, an understanding of supply markets and their dynamics, we try to be faster than our competitors to understand in which direction markets are moving. […] Anticipating market developments can be advantageous for the firm."* A purchasing executive at ECHO noted as follows: *"As we are close to the markets, to the industry, to manufacturers, to large retailers, we are quite close to new products, innovations and trends. […] For this, we have to identify market novelties and innovations as fast as possible, evaluate their relevance for our business and, of course, position them accordingly [in the firm] and place them in our offers."* A senior purchasing executive at BRAVO stated: *"Purchasing needs to be ahead in terms of knowledge. It should not happen that development approaches with a supplier or a technology that purchasing does not know about yet."* Essentially, proactive elements of supply market orientation reflect the notion that performance benefits through dynamic capabilities lie not only in the firm's ability to transform and reconfigure extant resources, but also in doing this in a rapid and timely manner, ahead of competitors (Eisenhardt & Martin, 2000;

Teece, 2007). Figure 1 illustrates both elements of supply market orientation.

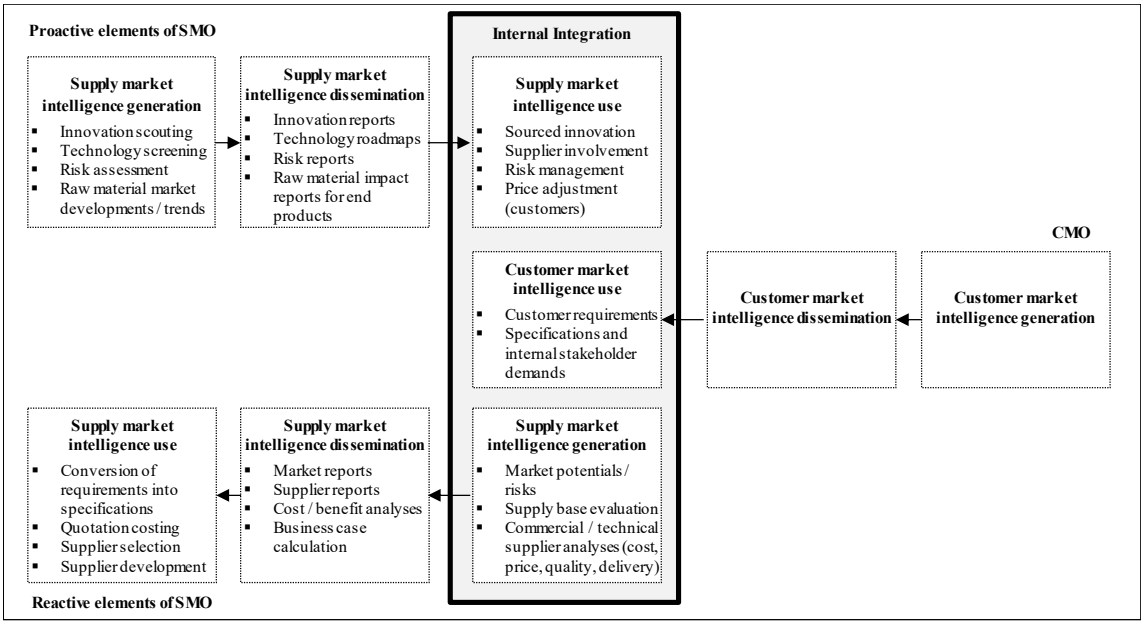

Figure 1: Proactive and Reactive Elements of Supply Market Orientation

Contributions, limitations and future research

Contributions to theory

We conceptualized and defined supply market orientation, thereby discussing how it is developed and how it differs within and across different firms (Table 2; Figure 1). We reflected our empirical observations against the background of the literature and the DCV for a more focused exploration and stronger substantiation of the results. Throughout the study, we provided empirical evidence and theoretical reasoning to endorse supply market orientation as a valuable dynamic capability

Our concept of supply market orientation recognized existing research in that it embraced the concept of supply market intelligence and the diverse concepts in purchasing and supply management that have often been adopted individually by firms to tackle the challenges of their particular supply environment. However, the concept of supply market orientation addressed the beneficial exploitation of supply market intelligence in the firm's various practices, processes, and organizational routines more directly, thus extending previous research in this area. In particular, we found that exploiting supply market intelligence allows firms to better observe the peculiarities of their supply environment and to then decide whether certain resources available in purchasing and supply management (or combinations thereof) will be more or less beneficial.

Furthermore, our concept of supply market orientation emphasized that firms not only accumulate and deploy dispersed resources, but rather integrate and reconfigure those resources in a way that best reflects their supply environment. Thereby, we found that firms can pursue their strategies more effectively through supply market orientation, as they sharpen their strategic focus, and thus channel efforts and investments into the most relevant resources and practices. Our results suggest different elements and configurations of supply market orientation. While firm-level elements span different purchase categories, category-level elements are specific to a certain purchase category. Moreover, reactive elements reflect a defensive stance, whereas proactive elements reflect a preventive stance and an endeavor to delve into uncharted territory.

Our results furthermore demonstrate that firms with advanced supply market orientation

are expected to exhibit more effective supplier integration and internal integration. Specifically, supply market orientation enables firms to make more informed integration decisions and to implement chosen integration practices more effectively, making the resulting integration more effective. In line with the DCV, we argue that the mere existence of dispersed resources in purchasing and supply management may not be critical for integration success. What is more important is how firms combine and reconfigure those resources to reflect their supply environment. Thereby, we emphasize that supply market orientation may well result in less integration, for example, for purchase categories sourced in a market situation where the firm is simply a price-taker.

Contributions to practice

Our results support the notion that uncertain and erratic business environments create the need for firms to build resources and capabilities to learn and adapt to new market conditions. In this regard, we provide valuable guidance for managers as to how supply market orientation may support them to cope with the challenges of an increasingly dynamic and complex global supply environment. Thereby, we support the notion that there is substantial benefit in actively generating and exploiting supply market intelligence in anticipation of its value rather than being reactively to customer market matters and internal stakeholder demands.

Since different configurations of supply market orientation are not equally useful in all possible situations, managers should place differing degrees of emphasis on the activities associated with generating, disseminating, and exploiting supply market intelligence. Thereby, our results show that the scope and focus of supply market orientation may well differ within the same firm, depending on the different purchase categories the firm sources, and the associated supply market environments. Furthermore, it is a first step to enable firms to more effectively utilize the value-adding potential of their integration practices. Supplier and internal integration can be the cause or the result of supply market intelligence generation and dissemination. More generally, supply market orientation helps managers assess how much integration is justified in which supply environment. This is particularly valuable for managers because, internal and supplier integration consume resources, pose risks and require investments in terms of money and time (Christopher, 2000; Koufteros et al., 2007; Schoenherr & Swink, 2012). In this regard, supply market orientation may prevent managers from misallocating valuable internal resources.

Limitations and future research

As with any inductive case-based research, our study lacks generalizability to some extent, even though we pursued a methodologically rigorous research approach. Thus, the next research step would be to deductively test constructs and relationships in a survey of multiple firms in diverse supply chains and industries. Thereby, future research could enlighten why some firms excel at effectively translating their dispersed resources into successful processes and capabilities while others do not. For example, there may be further critical differences between manufacturing and service firms, requiring future attention.

Incorporating supply market orientation as a potential intervening variable in empirical tests of the relationships between dimensions of supply chain integration and dimensions of operational performance and business performance may further contribute to the understanding of underlying relationships. Thereby, our results motivate future research to empirically test performance implications of supply market orientation at the firm and purchasing category level. In addition, the environmental uncertainty types might differ across industries or across different modes of production.

Our results indicate that supply market orientation may enable firms to better balance the supply chain and the demand chain. Schoenherr and Swink (2012) suggested that firms might accomplish synergies from the possession of superior capabilities with respect to opportuni-

ties and boundary conditions in both customer markets and supply markets. Thus, future research could investigate the role of supply and customer market orientation to attain supply chain fit and to effectively match demand and supply (Wagner et al., 2012).

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Goals, Conflict, Politics and Performance of Cross-Functional Sourcing Teams

Abstract

Strategic sourcing decisions are carried out in cross-functional teams to improve decision quality. Yet, cross-functionality also introduces behavioral challenges such as conflict and politics among team members. Based on data gathered in a social team experiments, we find a mediated effect of goal misalignment on politics via two types of inter-personal conflict. Perceptions of politics in turn obstruct rational team sourcing decisions. This study contributes to the scholarly understanding of the challenges that cross-functional sourcing teams face and enables PSM executives to reduce conflict and politics in sourcing teams and to ultimately enhance their decision outcomes.

Submission category: competitive paper

Keywords: global sourcing; teams; organizational politics;

Introduction

As a result of the outsourcing waves of recent decades, international and global sourcing have become integral elements of firm strategies and operations (Carter and Narasimhan, 1996; Trent and Monczka, 2003). In order to make effective sourcing decisions, various functions such as purchasing, logistics, R&D, production management, or marketing have to align and integrate (Mentzer et al., 2008; Trent and Monczka, 1994). Thus, these functions are interdependent in Purchasing and Supply Management (PSM) decision making processes, requiring functional representatives to exchange and jointly process information and combine their expertise in sourcing teams (Moses and Åhlström, 2008; Thompson, 1967). Such teams are temporarily formed and mandated to perform the vendor selection based on their diverse functional expertise (Foerstl et al., 2015).

It is well-established that cross-functional integration contributes to firm performance and supply chain effectiveness (e.g., Flynn et al., 2010), yet such diverse teams also face challenges from functional misalignment and conflicting motives that potentially interfere with rational decision making processes (Kaufmann et al., 2012; Moses and Åhlström, 2008). These challenges of cross-functional sourcing team integration have hitherto received little scholarly attention. Today, especially inter-personal conflict, self-serving politics, and their relationship in PSM team decision making remain underrepresented yet impactful phenomena (Bai et al., 2016; Thornton et al., 2016). Considering these research gaps, we pose the following research questions: (1) How do (mis)aligned goals affect conflict and politics in cross-functional sourcing teams and how are both related to each other? (2) What are the performance implications of conflict and politics in cross-functional sourcing teams?

This paper contributes to the yet emerging literature on conflict and politics in sourcing teams (e.g., Kaufmann et al., 2010; Kaufmann et al., 2012). Furthermore, we follow the call for more 'people-focused' PSM research, which is the primary underestimated PSM research theme today (Wieland et al., 2016). In our pursuit, we provide empirical evidence on political decision making processes within sourcing at the team level of analysis. Such political team processes are seldom observed even in general management and the organizational behavior domain outside PSM outlets (Vigoda-Gadot and Vashdi, 2012). Finally, this research enlightens us on which types of conflict should be prevented and which should be tolerated by firm leaders to serve team decision making and decision quality.

The remainder of the paper is structured as follows: First we reviews the emerging PSM team research and define our concepts of interest. Next, we develop our hypotheses based on

PSM and general management insight, present our methodology, and channel our results into a discussion of findings. We end with the implications of our research and future research opportunities that may fill the limitations that we accepted in this study.

Theoretical Grounding and Literature Review of Behavioral Research in Sourcing Teams

Cross-functional sourcing teams are regularly formed to make strategic decision about the upstream supply chain (Driedonks et al., 2010; Flynn et al., 2010). Functional representatives come from diverse backgrounds such as production, purchasing, marketing, or research and development and usually have divergent goals, expertise, or decision making styles (Kaufmann and Wagner, 2017; Moses and Åhlström, 2008). Cross-functional sourcing teams are examples of task-based functional integration that serves to solve a particular sourcing task through temporal rather than permanent integration (Foerstl et al., 2015; Miller and Dröge, 1986). Hence, such a team can be defined as a temporal collection of individuals from different functional units who have a common purpose of enhancing performance of a particular supplier selection (Mohsen and Eng, 2016).

Organizational buying behavior (OBB) literature has established that corporate buying is a multi-dimension, multi-person, and thus multi-perspective process, laying grounds for behavioral research in sourcing teams (Sheth, 1973; Webster Jr and Wind, 1972). Interestingly, original OBB models do account for conflict, negotiation, bargaining, and politicking as irrational sources of inefficiency (Johnston and Lewin, 1996; Sheth, 1973), yet we lack empirical evidence on such challenges of buying processes. For many years, this research stream has not been fully exploited(Sheth, 1996), particularly as it relates to global sourcing teams. It has been suspected that conflict and political dynamics affect PSM decisions (Moses and Åhlström, 2008; Stank et al., 2001), yet behavioral operations literature has hitherto not focused much on behavioral issues in teams. Building on the OBB tradition, we extend the research on behavioral sourcing that we present in the following.

Studies have begun transferring insights from OBB's process models to the sourcing team as unit of analysis, for instance in studies on uncertainty in sourcing decisions (Kaufmann et al., 2012; Kaufmann et al., 2014; Riedl et al., 2013). Accordingly, sourcing team research has added meaningful insights into decision making biases (Kaufmann et al., 2010), rationality (Kaufmann et al., 2014; Riedl et al., 2013), and team cohesion (Kaufmann and Wagner, 2017) in sourcing teams. Even more recently, initial findings on conflict and politics as specific challenges to sourcing teams have been published (Marshall et al., 2015; Stanczyk et al., 2015).

Exploratory inquiry into problems during cross-functional sourcing decisions detect that conflict as well as politics are significant challenges to PSM teams (Moses and Åhlström, 2008). Further studies show that the established types of conflict have different effects on PSM teams and that emotions are usually unproductive in conflict situations (Andre, 1995; Ehie, 2010). Such conflict can best be resolved by open and collaborative conflict resolution strategies (Oliva and Watson, 2011). Yet, qualitative observations indicate that collaboration can be obstructed for instance by power imbalance among team members as well as functional goal misalignment and political agendas of individual members (Stanczyk et al., 2015). Other observations add that effects of political agendas can vary depending on the underlying political goals of individuals in outsourcing projects (Marshall et al., 2015).

Overall, it can be concluded that "there is relatively little knowledge about the politics in and around teams" (Vigoda-Gadot and Vashdi, 2012, p. 287) and that "conflict and politics have traditionally been treated as separate literatures, and the link to connect both is understudied"

(Bai et al., 2016, p. 96). Thus, we develop hypotheses around goals, conflict, politics, and team performance to inform both PSM and general management research.

Hypotheses development

The proposed research model is shown in Figure 1, comprising six constructs and the relationships among them. Table 1 defines the six constructs. Our hypotheses around conflict are supported by extant literature[1] and serve validating purposes in the sourcing team context. In our model we focus on the 'conflict–politics link' and on the performance implications of politics in concordance with the research questions of this study.

Table 1: Construct Definitions

Name	Construct Definitions	Based on
Goal misalignment	Differences in the goals, interests, or priorities such as price, quality, security of supply, etc.	Stanczyk et al. (2015)
Task conflict	Disagreements among group members about the content of the tasks being performed	Jehn (1995)
Relationship conflict	Interpersonal incompatibilities among group members, which typically includes tension, animosity, and annoyance	Jehn (1995)
Perceptions of politics	Factors that contribute to employees perceiving a work environment as backstabbing, self-interest pursuing and unequally appraising.	Ferris and Kacmar (1992)
Procedural rationality	The extent to which the decision-making process reflects a desire to make the best decision possible under the circumstances.	Dean and Sharfman (1993a)
Team member satisfaction	The general state of joy, happiness, and satisfaction during and after the team work.	Jehn et al. (2010)

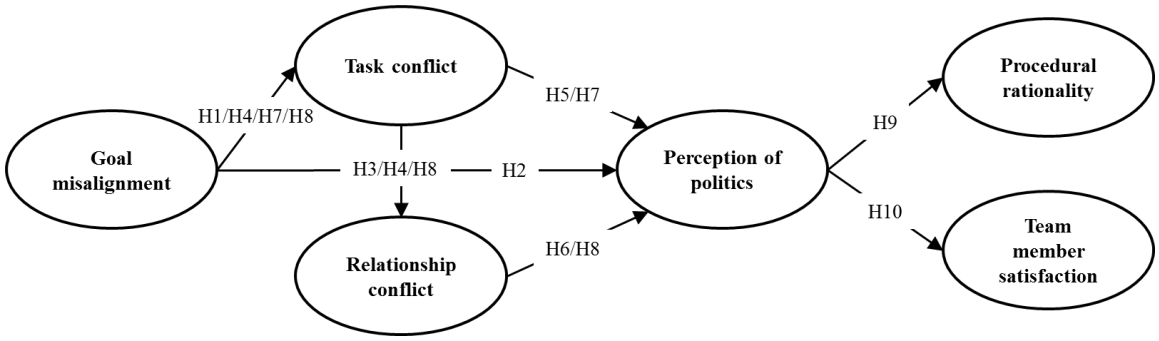

Figure 1: Research model (control variables omitted)

The effect of goal misalignment on conflict in cross-functional sourcing teams

Dissimilar goals lie at the heart of task conflict although conflict does neither in its conceptualization nor in its measurement instrument encompass misaligned goals as an explicit part of conflict (Jehn, 1995, 1997). The misalignment of functional goals in sourcing teams should still naturally drive task conflict among its members. Thus, we posit.

H1: Goal misalignment positively affects task conflict in cross-functional sourcing teams.

Extant research has indicated that misaligned goals create several problems in sourcing teams (e.g., Moses and Åhlström, 2008), yet PSM and organizational research remain unclear on whether misalignment alone can create the perception of politics in teams. POP may emerge under misaligned goals in a sourcing team based on a dual process: One alternative may be an

[1] This study in informed by a previous review of 165 publications on conflict and politics literature in and beyond teams outside the scope of PSM/SCM journals. We omit a review of this literature due to space limitations.

unjustified anticipation of politics. Functional managers realize goal misalignment during the team work if the misalignment was not anyhow clear ex-ante. Hence, team members may perceive politics based on the anticipation of self-serving or opportunistic intentions of their fellow team members solely due to mutually exclusive goals. Hence, they expect politics and experience POP since they are aware that others are incentivized to reach their functional targets as they are themselves.

H2: Goal misalignment positively affects POP in cross-functional sourcing teams.

Another alternative may be that managers are given justified evidence to support POP as soon as problems emerge in the team. For this path, however, we first need to establish connections between conflict types (H3, H3, H4) as well as between conflict and POP (H5, H6).

Several studies including longitudinal designs have hypothesized and successfully tested a positive causal effect of task conflict on relationship conflict, while the inverse claim remains unsupported (e.g., De Wit et al., 2012; Peterson and Behfar, 2003). Studies argue that intensive task conflict eventually leads to interpersonal annoyance and animosity, which are elementary parts of relationship conflict (Jehn, 1997). Therefore, we expect to replicate the driving effect of task conflict on relationship conflict at the team level.

H3: Task conflict positively affects relationship conflict in cross-functional sourcing teams.

Relationship conflict, however, is not naturally driven by the misalignment of goals per se but can depend on several contextual variables such as the team task, diverse cultural dimensions, or team familiarity (De Wit et al., 2012). Especially the latter has proven to be impactful because relationship conflict can be path dependent as past relationship conflict can trigger more relationship conflict (Peterson and Behfar, 2003). Yet, our study assumes a so called 'task-based' functional integration as sourcing teams being composed specifically for a discrete sourcing task rather than being permanently installed (Foerstl et al., 2015; Miller and Dröge, 1986). This assumption is in line with the strategic nature of supplier selection decisions, which are not part of regular day-to-day business. Members in temporary task-based sourcing teams usually have comparably little experience with one another due to their heterogeneous functional origins and hence should not suffer from path-dependent relationship conflict.

Still, extant studies have established mediation of task conflict's effect on team outcomes through relationship conflict. This rationale is based on a sequential escalation logic of slow or unproductive task conflict subsequently creating dissent on the emotional level, which then reduces performance outcomes (Camelo-Ordaz et al., 2015). Drawing on this argumentation, we hypothesize a mediation effect.

H4: Task conflict mediates the link between goal misalignment and relationship conflict in cross-functional sourcing teams.

The effect of conflict on POP in cross-functional sourcing teams

The functions in sourcing teams are interdependent meaning that they need to exchange resources such as information and documents through internal integration processes (Moses and Åhlström, 2008). In fact, they are reciprocally interdependent, meaning that one function's output is necessary as other functions' input and vice versa while making the global best decision for the firm as well as for finding local optima to serve misaligned functional interests (Stanczyk et al., 2015; Thompson, 1967). Conflicts restrict resource access as functional managers become hesitant to share information that may oppose one's own interests. Task and relationship conflicts

are hence resource constraining problems and consequently managers seek ways to work around them in order to still achieve their individual functional goals.

Political tactics can ease resource access in relations suffering from conflict (Gargiulo, 1993). Tactics that help ease resource access are, for instance, ingratiation towards important owners of information, coalition formation to overrule constraints, or selective information sharing to serve functional needs (Stanczyk et al., 2015). Such behavior in turns contributes to factors that contribute to employees perceiving a work environment as political in nature – that is POP. We expect both task conflict and relationship conflict to trigger POP in sourcing teams since both types of conflict obstruct individual resource access and can result in politics as coping strategy. Task conflict obstructs exchange processes based on rational incompatibilities of task-focused goals while relationship conflict obstructs exchange primarily based on irrational personal incompatibilities.

H5: Task conflict positively affects POP in cross-functional sourcing teams.

H6: Relationship conflict positively affects POP in cross-functional sourcing teams.

Moreover, when obstacles such as task or relationship conflict do emerge based on goal misalignment (H2, H3, H4), functional mangers experience even more POP than reasoned in H2. The mere anticipation of politics is now amplified by the immediate need to acquire resources through politics. We hence expect to find a mediating role of task conflict between goal misalignment and POP building on H1 or even a sequential double-mediation of both types of conflict towards POP. Thus, building on H2 and H4 we hypothesize.

H7: Task conflict mediates the link between goal misalignment and POP in cross-functional sourcing teams.

H8: Task conflict and relationship conflict double-mediate the link between goal misalignment and POP in cross-functional sourcing teams.

The effect of POP on performance outcomes of cross-functional sourcing teams

As derived above, functional managers need to retrieve information and specific knowledge from other functions to perform their analysis and contribute to effective decision outcomes in cross-functional sourcing teams (Moses and Åhlström, 2008). Ideally, all team members focus their attention at the multi-lateral retrieval processes that are necessary to integrate interdependent task information on complex decisions (Mell et al., 2014). Organizational research, however, suggests that when the environment is charged with POP, the dominant response strategies chosen by employees are either to withdraw in order to protect oneself from negative emotional and psychological consequences of POP or to engage in politics more intensively to win the political game (Hsiung et al., 2012; Wiltshire et al., 2014). Since individuals in teams rather than broader organizations tend to refrain from withdrawing (Maslyn and Fedor, 1998), team members are only left with playing along to win. This means that POP not only obstructs integration and retrieval processes based on misaligned goals, but shifts team members' attention to exerting political influence, rather than combining interdependent task information (Kaufmann et al., 2010). Managers hence focus more on managing their resource constraining counter-parts via political tactics rather than making use of the information necessary to make the best decision (Dean and Sharfman, 1993a, 1996; Eisenhardt and Bourgeois, 1988). Hence, we expect that this obstruction reduces reduce the rationality of the decision making process.

H9: POP negatively affects procedural rationality in cross-functional sourcing teams.

Several studies have supported that POP in organizations reduces satisfaction of employees with their job (Miller et al., 2008). However, studies have shown that allegedly

straightforward and well-researched links, such as POP and withdrawal from the job, can be challenged in the team context (Maslyn and Fedor, 1998) (see H9). Thus, we seek to trace the effect of POP on our second performance outcome dimension, team member satisfaction.

POP reflects that inter-personal relations rather than individual effort determine personal goal achievement in organizational research (Ferris and Kacmar, 1992). Similarly in sourcing teams, political conditions weaken the impact of individual analytical scrutiny on goal achievement and elevate the ability to retrieve information and other resources via political tactics as success factor. Altering the individual 'effort-outcome function' by introducing political exchange standards contradicts the ideology of fair treatment and rewards (cf. Andrews et al., 2003). Hence, under these unfair conditions, individual rewards and appreciation by functional peers become more uncertain as increasing POP further reduces the effect of effort on personal outcomes. Such uncertainty reduces the satisfaction with the team-work overall since a clear estimation of expected individual rewards cannot be made. We formulate our final hypothesis.

> **H10:** POP negatively affects team member satisfaction in cross-functional sourcing teams.

Research Methods

We choose a social experiment at the team level in order to effectively control extraneous influences and extract solid inferences about our dependent variables. We selected, the vignette-based experiment method which has become well-accepted in behavioral operations (Bachrach and Bendoly, 2011; Croson et al., 2013) and sourcing research (Knemeyer and Naylor, 2011). Subsequently, we describe our experimental design, its variables and measures, as well as our treatment of possible biases.

Experimental Design and Data Collection

Our experimental design follows the methodological guidelines for vignettes (Bachrach and Bendoly, 2011) and a recent example of a complex team experiment (Mell et al., 2014). We chose to conduct an on-site experiment including real team interaction (event technique) on a sourcing task to foster perceived realism (Koschate-Fischer and Schandelmeier, 2014). The vignettes were generated through iterative discussions with researchers and professionals following the guidelines by Rungtusanatham et al. (2011). The baseline-situation describes a hypothetical manufacturing firm Bronson Inc. facing a selection of an important supplier. In order to continue serving the market with motorcycles, the sourcing team needs to successfully select a new engine supplier. We randomly assigned participants into teams of three and likewise randomly assigned the teams to one of the two experimental conditions (see next section). Due to space constraints the baseline scenario and the vignettes are not presented in the paper. The full material is available from the authors upon personal request.

All participants received a general briefing about the process, individual rewards, and the study's rules before individual instruction emails were sent out. After completing an online survey tool on several control variables, team members were instructed to read their individualized instruction email that framed each participant into an upcoming supplier selection meeting for a strategic sourcing item (motorcycle engine) and an individual functional background (purchasing, marketing & sales, or R&D) along with explicit functional goals (e.g., supplier flexibility). All instruction e-mails contained an individualized document with information items on four possible suppliers and a spreadsheet that would assist participants in their pre-meeting analysis. After 30 minutes of individual analysis, participants were asked to

perform manipulation checks and to select their current preferred supplier in an online survey tool.

Next, the individuals formed a cross-functional sourcing team (as earlier randomized) and were given up to 60 minutes to come up with a supplier selection as the outcome of their self-guided group discussion. During the discussion, participants had to retrieve relevant information from fellow team members to find their preferred supplier reflecting high functional interdependency (Moses and Åhlström, 2008; Thompson, 1967). Teams were seated at a table in closed meeting rooms. After a decision had been made, all participants individually filled out an online survey tool on all mediating and endogenous variables of our model. Finally, we thanked and de-briefed the participants and handed over their rewards.

Experimental Conditions and Manipulation

Participants were either instructed to maximize benefits and minimize costs in their choice according to a set of identical indicators (goal alignment) or a function-specific set of indicators (goal misalignment). Hence, the newly developed experimental design is based on two different conditions of goal misalignment. This instruction was explicitly coupled to the performance-based rewards while participants were not aware of other function's goals initially.

Literature is ambiguous whether experiment subjects should be incentivized. We incentivized our participant because previous performance-based pay-outs have shown several positive effects such as increased data quality (Hertwig and Ortmann, 2001). We sampled professionals enrolled in part-time graduate programs. They were incentivized with both fixed and performance-based course credit where possible (10-15% of their grade) or monetary incentives where course credit was infeasible (5€ for attendance and 5€ performance-based) (Koschate-Fischer and Schandelmeier, 2014). We found no significant difference between the two types of incentives in terms of engagement as a measure of participants motivation (7-point scale) (mean cash=5.3; mean course credit=5.5; p=0.25, not significant). The rewards are small enough for participants to perceive them as small 'thank you' and not compare them to their opportunity costs of participation (Koschate-Fischer and Schandelmeier, 2014).

Sample characteristics

We recruited full-time employed participants only and distribute our sampling across several sub-groups to ensure validity of our findings (Knemeyer and Naylor, 2011). The participants are part-time graduate students and executive MBA students (214 in total) who are all fully employed as sustainability, procurement, and commercial or technical supply chain agents or other departments such as sales and marketing, to mirror the cross-functionality of PSM teams. Overall, 85 female and 129 male individuals have participated. The sample is on average 26.3 years old, has 4.5 years of work experience predominantly in manufacturing (25%), services (13%), and finance (13%) industries (first-level SIC) and is familiar with team work (5.6) as well as engaged in the experimental task (5.5) on a seven-point Likert scale.

Variables and Measurement

We vary the independent variable goal misalignment on two levels by giving out aligned and misaligned goals in the sourcing teams and verifying the manipulation ex-post based on the 'goal similarity' scale (Jehn, 1995). Our dependent variables are task conflict, relationship conflict, POP, procedural rationality, and team member satisfaction. We operationalized task conflict and relationship conflict with the widely used scale items in Jehn (1995) and used parts of the Kacmar and Carlson (1997) instrument for POP. Adjustments to the POP scale were necessary such as replacing the term 'organization' with 'committee' and excluding items that are

not applicable to the team context. We further used 'committee' instead of 'team' to avoid significant bias towards cooperation detected in extensive pre-tests. Adjustments are in accordance with extant PSM and organizational literature (Bai et al., 2016; Maslyn and Fedor, 1998). Finally, we assess team performance with procedural rationality drawing on Dean and Sharfman (1993a) and measure team member satisfaction using a scale instrument used in Jehn et al. (2010). We chose to proxy team performance with rationality and satisfaction as suggested by extant studies (Jehn et al., 2010; Riedl et al., 2013).

Regardless of their assigned group, all participants read the same baseline-scenario that provided information about the company, industry, firm size, sourcing item, decision importance etc. Thus, we are controlling for factors that are commonly known to influence strategic decision making processes (Dean and Sharfman, 1993b). We also captured respondents' age, gender, work experience, industry, familiarity with teamwork, perceived realism of the setting, and engagement. Most are omitted in the following analysis since only engagement had a significant influence on our dependent variables. We slightly adapted engagement items to the focus on the 'task' instead of on the 'job' (Rich et al., 2010).

Table 2: Measurement Model Properties and Loadings

Construct (alpha; CR; AVE) *Original Item*	Item Code	PLS loading	AMOS loading
Engagement (alpha .917; CR .932; AVE .705) (Rich et al., 2010)			
I worked with intensity on the task.	Eng1	.857	.824
I tried my hardest to perform well on the task.	Eng2	.815	.750
I exerted my full effort to the task.	Eng3	.877	.855
I exerted a lot of energy on the task.	Eng4	.814	.795
I strived as hard as I can to complete the task.	Eng5	.827	.781
I devoted a lot of energy to the task.	Eng6	.848	.831
Goal misalignment (alpha .794; CR .878; AVE .706) (Jehn, 1995)			
As a committee we have similar goals (reversed).	GoalMis1	.850	.843
The main goals of my committee are the same for all members in my committee (reversed).	GoalMis2	.854	.826
We (my committee) all agree on what is important to our committee (reversed).	GoalMis3	.816	.629
Perceptions of politics (alpha .861; CR .902; AVE .643) (Kacmar and Carlson, 1997)			
People spend too much time sucking up to those who can help them.	Pop1	.783	.710
People are working behind the scenes to ensure that they get their piece of the pie.	Pop3	.819	.752
Individuals are stabbing each other in the back to look good in front of others.	Pop4	.789	.697
People do what's best for them, not what's best for the committee.	Pop5	.748	.706
There is a lot of self-serving behavior going on.	Pop6	.868	.855
Procedural rationality (alpha .712; CR .828; AVE .634) (Dean and Sharfman, 1993a)			
How extensively did the committee look for information in making this decision?	ProcRat1	.748	.614
In general how effective was the committee at focusing its attention on crucial information and ignoring irrelevant information?	ProcRat3	.792	.668
How extensively did the committee analyze relevant information before making a decision?	ProcRat4	.846	.745
Relationship conflict (alpha .890; CR .924; AVE .752) (Jehn, 1995)			
How much emotional conflict is there among members in your team?	Rc1	.882	.853
How much are personality conflicts evident in your committee?	Rc2	.8881	.818
How much interpersonal tension is there among members in your committee?	Rc3	.874	.823
How much friction is there among members in your committee?	Rc4	.830	.784
Task conflict (alpha .868; CR .910; AVE .718) (Jehn, 1995)			
To what extent are there differences of opinion in your committee?	Tc1	.756	.653
How frequently are there conflicts about ideas in your committee?	Tc2	.875	.842
How much conflict about the work you do is there in your committee?	Tc3	.871	.830
How often do people in your committee disagree about opinions regarding the work?	Tc4	.881	.831
Team member satisfaction (alpha .927; CR .910; AVE .718) (Jehn et al., 2010)			
I was very satisfied working with this committee.	Satis1	.939	.914
I was happy working with this group.	Satis2	.946	.933
How much did you enjoy working on this task with your committee members?	Satis3	.918	.857

PLS measurement model properties; Model fit of comparative AMOS analysis: χ^2=866.8; χ^2/df=2.21; CFI=.890; RMSEA=.075

Validity assessment and Measurement Model

As recommended by Anderson and Gerbing (1988), the following analyses were conducted to assess construct validity and reliability. Previously validated scales, a thorough literature review, and a pre-test were used to ensure content validity (Forza, 2002). Several rounds of pre-tests with practitioners and scholars resulted in several major revisions of the material. We improved other and length of the material until no further progress could be made.

Confirmatory factor analysis (CFA) in AMOS was used to assess convergent validity. The results indicated to narrow down items for POP and procedural rationality. We only accepted items above the recommended cut-off value (Nunnally, 2010). Scale reliability was assessed based on Cronbach's alphas and composite reliability for each scale. Finally, all variance inflation factors range below 5 (most below 3), indicating that multicollinearity was negligible (Kock and Lynn, 2012). All details on our variables are summarized in Table 2.

Furthermore, the comparison of the square root of the AVE for each construct and the corresponding correlation coefficient (see Table 3) supported discriminant validity (Fornell and Larcker, 1981).

Table 3: Construct Correlation Matrix

	EN	GM	POP	PR	RC	TC	TMS
Engagement (EN)	.804						
Goal misalignment (GM)	-.421**	.840					
Perception of politics (POP)	-.322**	.550**	.808				
Procedural rationality (PR)	.399**	-.428**	-.504**	.796			
Relationship conflict (RC)	-.290**	.504**	.759**	-.418**	.867		
Task conflict (TC)	-.238**	.592**	.639**	-.382**	.746**	.847	
Team member satisfaction (TMS)	.586**	-.595**	-.589**	.509**	-.550**	-.493**	.876

* $p < 0.05$; ** $p < .01$; diagonal shows square root of AVE (Fornell and Larcker, 1981)

Manipulation Checks and Bias Treatment

Several steps were taken to reduce concerns on manipulation failure, realism of the study, common method bias, social desirability, and bias via incentives. To check the effectiveness of the manipulation, we perform a qualitative manipulation check to verify the coupling of goal indicators to the performance-based rewards right after the analysis of the vignette material and additionally measure goal misalignment in the final ex-post survey instrument (Perdue and Summers, 1986). 89% performed the qualitative manipulation check correctly, while a two-sample t-test on goal misalignment survey responses shows a significant difference of means between the conditions at the 0.01 significance level.

Experiments are criticized for lack of realism (e.g., Bachrach and Bendoly, 2011), however research shows that the perception of realism matters to participants instead of the actual embeddedness into a real firm context (Koschate-Fischer and Schandelmeier, 2014). Participants rate the experiment as relatively realistic (4.4). Overall, 113 participants have rated the experiment realistic (>4), which can be considered a good result given the challenge to convey a realistic lab experiment.

Common method bias (CMB) was assessed by applying Harman's single-factor test (Harman, 1976). The principal component analysis revealed the first factor accounted for only 39.2% of the total variance and 5 additional factors with eigenvalue greater 1 were identified. CFA revealed that the single-factor model did not fit our data well across all samples (χ^2=2967.33; χ^2/df=3.45; CFI=.481; RMSEA=.121) (Korsgaard and Roberson, 1995). Therefore, we conclude that CMB did not significantly impact our structural model estimations.

Measurement of social desirability bias did not yield significant influence on our results. Moreover, given the team setting social desirability of an individual is less of an issue. We followed the experimental and survey design recommendations to limit the influence of CMB and social desirability bias (Bachrach and Bendoly, 2011; Rungtusanatham et al., 2011).

Results

We tested our hypotheses using structural equation modelling. Please see Figure 2 for a summary of estimations of the structural model and the hypotheses tests, which are subsequently summarized per hypothesis. Our results show that goal misalignment created task conflict among the cross-functional sourcing team (H1; β=.595, p<.01; see Table 4) and that misaligned goals also create POP based on an anticipation of politics (H2; β=.214, p<.01). Thus, we accept H1 and H2. Furthermore, the model supports the direct link between task and relationship conflict (H3; β=.718, p<.01). Furthermore, we test whether task conflict mediates the link between goal misalignment and relationship conflict (H4). Since both H1 and H3 are supported, a mediation effect is theoretically feasible. The Sobel-test statistic for H4 is 119.5 exceeding the ±1.96 cutoff at p<.01 (two-tailed) (Sobel, 1982).

Figure 2: Research Model Results

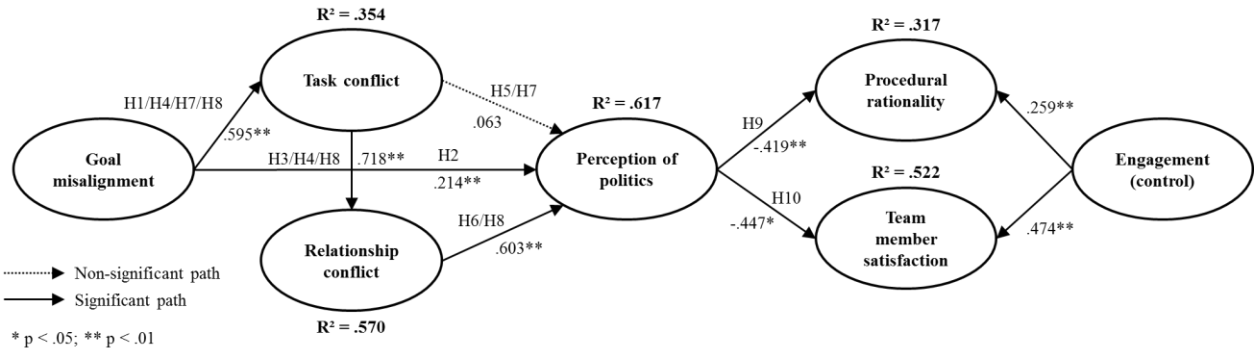

Table 4: Path Coefficients and Total Effects

Substantive relations	Path coeff. (stdev)	Total effect (stdev)	Hypothesis
Goal misalignment →Task conflict	.595 (0.045)**	.595 (0.045)**	H1 (accept)
Goal misalignment →POP	.214 (0.047)**	.509 (0.048)**	H2 (accept)
Task conflict →Relationship conflict	.718 (0.041)**	.718 (0.041)**	H3 (accept)
Task conflict →POP	.063 (0.064)	.063 (0.064)	H5 (reject)
Relationship conflict →POP	.603 (0.064)**	.603 (0.064)**	H6 (accept)
POP →Procedural rationality	-.419 (0.058)**	-.419 (0.058)**	H9 (accept)
POP →Team member satisfaction	-.447 (0.061)**	-.447 (0.061)**	H10 (accept)
Mediation	Specific indirect effect		
GM → TC → RC	.427 (.046)**	-	H4 (accept)
GM → TC → POP	.037 (.041)	-	H7 (reject)
GM → TC → RC → POP	.258 (.036)**	-	H8 (accept)

p-Values calculated using bootstrapping method; * p < 0.05; ** p <.01

Additionally, we tested for mediation using bootstrapping. Supporting H4, we found an indirect effect of goal misalignment through task conflict on relationship conflict of .427 at p<.01 (Table 4). Since task conflict does not show a direct effect on POP (β=.063, p=.35), we reject H5. Relationship conflict, however, does show the hypothesized positive effect on POP (β=.603, p<.01) to support H6. H7 found no support because a necessary link between parts of the mediation model was not found significant (H5). Moreover, Preacher and Hayes (2008) recommend using bootstrapping to assess multiple mediation. The specific indirect effect of goal

misalignment through both types of conflict (β=.258) was found significant at p<.01, supporting H8 (see Table 4 bottom). Finally, we tested whether POP affects procedural rationality and satisfaction and found support for its detrimental effect on rationality (β=-.419, p<.01) and on team members satisfaction (β=-.447, p<.01). Hence, we accepted H9 and H10.

Discussion

Theoretical implications and future research

While our results indicate a single mediation path from goal misalignment to POP apparently sourcing teams perceive politics when functional representatives need to use politics to overcome relationship conflicts (H5, H6).Only relationship conflict serves as sufficient trigger for representatives to give up rational negotiation and engage in political influence tactics that cause POP (H6). Task conflict does not drive POP, which indicates that managers do not need to counter-act task conflict in sourcing teams, which can even have positive effects (De Wit et al., 2012). In this study, task conflict does not show its rationalizing effect, possibly because participants were either way focused on discussing the provided data during the experiment. This could or could not be a limitation of this research given that task conflict's effect are highly context specific (De Wit et al., 2012). Future research could substantiate the merits or danger of task conflict in sourcing teams.

Second, this study observes the inter-relation of conflict and politics in teams. Extant studies have taken the perspective of politics causing conflict but treated goals and politics as aggregate: "Teams of this [political] sort usually have low goal compatibility as everyone in the team pursues different goals. According to the structural perspective, competition and conflict arises" (Bai et al., 2016). We have disentangled the relation of goals, conflict, and politics in this study. Future research could dive deeper into the mutual relation of conflict and politics and include the actor-based political behavior perspective (Allen et al., 1979) to test a circular relationship between conflict and the two dimensions of politics, POP and political behavior. Assessing coalition formation, lobbying, control of agendas, and strategic use of information is certainly a methodological challenge (Eisenhardt and Zbaracki, 1992), but can be expected to unveil potential counter measures to prevent negative effects on sourcing team effectiveness.

The final main theoretical implication of this research is that we have identified a chain of problems in cross-functional teams building on earlier collection of success factors and possible pitfalls (Moses and Åhlström, 2008; Trent and Monczka, 1994). The identified complex mediation path mirrors OBB in that it shows a complex process of sequentially emerging problems in a multi-person and multi-perspective team (Webster Jr and Wind, 1972). Future research's task is to trace the right point in time to intervene. Longitudinal research may be able to more closely track the emergence of conflict, politics, or other behavioral challenges in sourcing teams and observe shifts from functional to dysfunctional effects. Here we would like to stress that task conflict has proven to have positive effects in other research contexts (De Wit et al., 2012). Hence, we advise future research to substantiate our outcomes for other cross-functional sourcing team settings. An inductive finding of this research remains that the double-mediated 'goal misalignment-POP link' (H8) could be extended to both procedural rationality (-.108, p<.01) and team member satisfaction (-.115, p<0.01). Despite the complexity of the mediation path, they account for 50.7% and 50.4% of the total effect, respectively. Task conflict might be a leverage point to team value creation either causing relationship conflict and subsequent problems (H8) or inhibiting negative consequences.

Managerial implications

Our study reminds managers that cross-functional sourcing team processes are charged with behavioral challenges that analytical decision tools cannot overcome or manage. We show how misaligned goals subsequently lead to conflict and politics in sourcing teams to finally reduce the rationality of decision outcomes and overall decision performance (Riedl et al., 2013). Similar to organizational buying overall (Sheth, 1973), problems in sourcing teams emerge in a step-wise escalation process: misaligned goals lead to conflicts, which lead to politics and further negative outcomes. Goals and incentive structures are hard to change and should not even be aligned in case they support procedural rationality. Research has supported that task conflict (i.e., controversial discussion about the task) has rationalizing effects for decision outcomes (De Wit et al., 2012). Our results indicate that if managers and team leaders achieve to reduce emotionality in conflict situations, not only detrimental relationship conflict but also politics and further negative performance implications such as low rationality and satisfaction will not manifest.

Conclusion

In responding to the initial research questions, we found that misaligned goals create task conflict and that task conflict subsequently drives emotional relationship conflict in sourcing teams. Our main contribution is evidence for two extensions of this mediation. Relationship conflict further leads to perceptions of politics, which in turn reduces team member satisfaction and procedural rationality along with the overall performance of the sourcing decision (Riedl et al., 2013). Hence, this study has shown that problems in cross-functional sourcing teams emerge as step-wise escalation process, in accordance with the procedural perspective taken in OBB theory. We hope to motivate future research to investigate sourcing teams in general and particularly team conflict, team politics, their mutual relation, and suitable mitigation strategies to avoid negative outcomes while making use of the positive aspects of cross-functional integration (De Wit et al., 2012; Stanczyk et al., 2015).

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An investigation of commodity price risk assessment: insights from information processing theory

Barbara Gaudenzi
University of Verona, Department of Business Administration, Via Cantarane, 24 - 37129 Verona, (Italy), tel +39 0458028623, barbara.gaudenzi@univr.it

Janet L. Hartley
Department of Management College of Business, Bowling Green State University, Bowling Green, OH 43403 (USA), (419) 372-8645, jhartle@bgsu.edu

George A. Zsidisin*
Department of Supply Chain Management and Analytics, School of Business, Virginia Commonwealth University, Richmond, VA 23284 (USA), gazsidisin@vcu.edu
*author for correspondence

Lutz Kaufmann
SCM Group WHU – Otto Beisheim School of Management, 56179 Vallendar, (Germany), +49 261 650 9320, kaufmann@whu.edu

Abstract
Many firms are exposed to price volatility from commodity purchases, which poses a financial risk to their firms. We investigate how organizations acquire, analyze, and disseminate information when assessing commodity price risk from an Information Processing Theory (IPT) perspective. The results of 12 case studies with companies in Germany, Italy, and the U.S. show varied approaches for acquiring, integrating, distributing, and creating shared meaning. Market indices, external service providers, informal discussions, and formal market research are primary sources of commodity price volatility information when assessing price risk exposure, and is a key precursor for mitigating this form of risk.

Key Words: commodity risk assessment, information processing

1. Introduction

For organizations purchasing raw materials, energy products or components with a high level of raw material content, uncertainty in commodity prices is a serious challenge. Prices for commodities, such as agricultural crops, crude oil, and metals are driven by the market's perceptions of underlying factors influencing supply and demand, and thus are constantly changing. Managers must make decisions about product innovation and design, purchase timing and quantities, budgeting, pricing, and risk mitigation strategies without knowing exactly what commodity prices will be in the future. As highlighted by Matook *et al.* (2009), the entire commodity portfolio should be managed using a risk management process. Further, in most cases, actions by individual organizations within the market structure will not influence

prices. Thus, supply chain managers must develop strategies for mitigating their organization's exposure to price risk (Gaudenzi *et al*., 2017; Zsidisin and Hartley, 2012).

Commodity price risk has been ranked as one of the top 10 risks faced by organizations (BDO, 2016; World Economic Forum, 2015; Deloitte University Press, 2015; Dobbs *et al*., 2013). Commodity price risk has a significant impact on an organization's short-term and long-term financial performance, for example the cash-to-cash cycle, value of purchases, and value of inventories (Rampini *et al*., 2014; Arezki *et al*., 2014; Kalari and Power, 2013; Jacks *et al*., 2009). Commodity prices may also be related to economic-political decisions, such as in the case of fuel trade and price strategies (Davarzani *et al*., 2015), and to stock prices (Gaudenzi and Bucciol, 2016; Wen *et al*., 2014; Bandaly *et al*., 2013; Creti *et al*., 2013; Vivian and Whoar, 2012; Henriques and Sadorsky, 2011). However, empirical investigations on the commodity price risk assessment process from a supply chain perspective are limited (Fischl *et al*., 2014).

Our research aims to address this gap in the literature by investigating how organizations acquire, analyze, and disseminate information when assessing commodity price risk, the important first step in the process for mitigating commodity price risk. Using case studies, we examine how manufacturing companies in different industries assess commodity price risk for their direct purchases and those made by first tier suppliers. We identify factors that may explain the choice of assessment approaches and suggest effective practices, using information processing as the theoretical lens (Wiengarten *et al*., 2017; Tazelaar and Snijders, 2012; Tushman and Nadler, 1978; Galbraith, 1973, 1974). Risk assessment is a process that involves gathering, analyzing, and using information to determine the probability of a risk occurring and its effect on the organization (Zsidisin *et al*., 2004; Harland *et al*, 2003). Although several studies have examined various types of supply chain risk management processes from an information processing perspective (Fan *et al*., 2017; Fan *et al*., 2016; Kauppi *et al*., 2016; Bode *et al*., 2011; Hult *et al*., 2004), the process used to *assess* supply chain risk, and commodity price risk in particular, has received scant attention. The majority of previous studies highlight the importance of information processing, focusing on disruption risk or supply chain risk as a whole (Revilla and Saenz, 2017). However, we are not aware of any studies exploring how the assessment process is developed, or studies specifically analyzing commodity price risk assessment processes. Our results contribute to theory and practice by providing guidance on how firms assess commodity price risk.

The next section provides a background of commodity price risk, and Information Processing Theory (IPT) is then discussed within the context of supply chain risk management research. We describe the grounded-theory approach (Pinnington *et al*., 2016; Denk *et al*., 2012; Manuj and Pohlen, 2012; Strauss and Corbin, 1998; Strauss, 1987) used to gather and analyze data from case studies of 12 manufacturing companies located in United States, Italy, and Germany. Results and managerial implications are described. Conclusions, limitations and opportunities for future research are then provided.

2. Information processing theory and commodity price risk assessment

Commodity price risk management is a process that requires assessing price risk and then deciding which are the most effective and efficient mitigation strategies for assuring a good mix of risk control and risk financing (ISO Guide 31.000, 2009; Faisal *et al*., 2007). Information processing is needed to address uncertainty and equivocality and facilitate organizational decision-making (Wiengarten *et al*., 2017; Daft and Lengel, 1986; Tushman and Nadler, 1978; Galbraith, 1973) when assessing commodity price risk. An organization's

information processing capabilities should fit with its information processing needs (Daft and Lengel, 1986; Tushman and Nadler, 1978), playing a potential moderating role in the complexity-performance relationship (Wiengarten *et al*., 2017). Information processing theory suggests as uncertainty increases, organizations must develop the capability to process more information or reduce the need for information through the use of slack resources, with the fit between information processing capability and processing needs affecting performance (Tushman and Nadler, 1978; Galbraith, 1974).

Empirical studies have applied IPT to the management of supply chain risk (Kauppi *et al*., 2016; Fan *et al*., 2017; Fan *et al*., 2016; Bode *et al*., 2011). Bode *et al*. (2011) suggest that firms gather and process information to determine if and how to respond to supply chain disruptions but do not examine assessment approaches in their study. Kauppi *et al*. (2016) suggest that customer and supplier integration increases information processing capabilities and find higher levels of integration are related to greater use of risk management practices which encompass prevention, dectection, response, and recovery. Revilla and Saenz (2017) highlight the need to share risk information externally with other supply chain partners. Fan *et al*. (2016) find the positive relationship between information sharing in the supply chain and information analysis with operational performance is enhanced when products are customized, or when there is technological or market turblence. Risk information sharing and risk assessment are both positively related to risk sharing in the supply chain (Fan *et al*., 2017). Thus, although research suggests information processing is essential for risk assessment, the process used to assess commodity price volatility and risk has not be explored. Therefore, in this research, we examine the processes supply chain managers use to assess commodity price risk. IPT suggests that companies facing greater uncertainty, for example the highly servitized firms (Benedettini *et al*., 2015) and those where commodity purchases account for a large percentage of purchases or purchases commodities in which market data are not readily available would need to develop more information processing capabilities (Fan *et al*., 2017).

Researchers have conceptualized information processing steps in different ways. Tushman and Nadler (1978) conceptualize information processing as involving the steps of gathering, interpreting, and synthezing information. Gathering involves collecting relevant information, interpreting involves assigning importance and significance to information, and synthezing involves understanding the relationships among elements (Turner and Makhija, 2012). In a final step, to support decision-making, information must be shared within the organization (Tushman and Nadler, 1978). Daft and Weick (1984) suggest that organizations gather data, interprete the data, and then take action. Building upon organizational learning (Huber 1991), Hult *et al*. (2004) conceptualize information processing to develop knowledge in a supply chain context as consisting of knowledge acquisition, information distribution, and shared meaning. Further, Huber (1991) states developing a common understanding about data results in the development of shared meaning. Information processing theory has been also applied to the management of complexity and uncertainty in supply chain networks (Wiengarten *et al*., 2017; Li *et al*., 2014).

In a supply chain risk management context, researchers have not adopted a consistent model of information processing for risk assessment. For example, Fan *et al*., 2017 conceptualize three steps in the process, risk information sharing, risk analysis and assessment. Several studies use two steps for information processing during risk assessment, information gathering and information dissemination (Fugate *et al*., 2009; Carr and Lopez, 2007; Hult *et al*., 2004; Conduit and Mavondo, 2001). Khan and Burnes (2007) distinguished the phases of collecting, processing and applying supply chain risk information. In this research, we examine

information processing for commodity price risk assessment, applying the steps proposed by Hult *et al*. (2004) of 1) acquiring information, 2) interpreting information, 3) distributing information and 4) creating shared meaning.

3. Methodology

The research methodology consists of gathering and analyzing qualitative data from 12 firms headquartered in the United States, Italy, and Germany. We used a grounded theory approach (Strauss and Corbin, 1998; Strauss, 1987) to gain an in-depth understanding of the risk assessment process for commodity price risk, to apply and expand upon on existing theories about commodity price risk mitigation strategies (Zsidisin and Hartley, 2012), and to build new theories about those factors influencing the risk assessment. The methodology was designed to meet the grounded theory criteria of fit, understanding, generality and control (Strauss and Corbin, 1998; Strauss, 1987). The initial idea to study commodity price risk assessment was developed based on a review of the supply chain risk management literature helping to ensure the findings fit with the substantive area of risk assessment. Further, respondents participated in providing data through interviews, reviewed the interview transcripts, and subsequently received a report of the study's findings helping to facilitate fit and understanding. To ensure generality, the semi-structured interviews lasted one hour or more and thus were long enough to ensure that respondents could provide their own diverse perspectives.

3.1 Sample and Interview Process

In this study, qualitative data were gathered from interviews with supply management and risk management professionals in 12 firms headquartered in the United States, Italy, and Germany using a grounded theory approach (Strauss and Corbin, 1998; Strauss, 1987). The sample (Table 1) was selected so differences in headquarters country, organizational size, industry and the variety of commodities purchased could be examined (Flyvbjerg, 2006). The companies were assured of anonymity and thus their actual names are not used. The sample includes five larger companies, with revenues of ten billion $/€ or more, five medium-sized companies (revenues more than one and less than ten billion $/€) and two smaller companies whose revenues are less than one billion $/€. Companies operate in the chemical, packaging, transportation, aerospace, equipment manufacturing, and food industries. A wide range of commodities were explored including wheat, coffee, cocoa, steel, aluminum, polyethylene, wood fiber, and rubber.

Table 1. Case study firm and commodity characteristics

Country	Code	Industry	Firm size*	Commodities Investigated	Commodity Characteristics
U.S.	INTG	Integrating manufacturer	Medium	Plywood, Oriented Strand Board (OSB), Steel	More than 65% of purchases is on price volatile commodities
	EQUIP	Equipment manufacturer	Large	Steel, rubber, Styrene-Butadiene Rubber (SBR: an oil derived product)	Steel accounts for approximately 25 % of total purchases
	PACK	Plastic Components	Medium	Polypropylene	About 70 % of overall spend is for polypropylene
	VEICL	Commercial vehicles	Medium	Steel, aluminum	Aluminum and steel account for a large part of total purchases
	CONS	Food Production	Large	Corn, wheat, soybeans, vegetables	Price-volatile commodities account for 50 % of the overall spend
Italy	PASTA	Food production	Medium	Common wheat and durum wheat	The cost of these commodities accounts for 45% of the cost of costs of goods sold
	FLY	Aerospace	Medium	Carbon fiber, aluminum, titanium	14% of overall spend is on key commodities
	CHEM	Chemical	Small	Ethylene, Propylene (oil derived products)	85% of overall spend is on these two commodities
Germany	CAR	Automotive	Large	Steel	20% of overall spend is on commodities, with half being steel
	CHOC	Food Production	Small	Chocolate/cocoa	20% of the overall spend is on these commodities
	ELEC	Electronics	Large	Steel	The purchasing spend is 50 % of total sales
	COFF	Food Production	Large	Coffee	Commodities are the most volatile part of costs of goods sold

*Large firms have revenues exceeding 10 billion $/€; medium firms have revenues between 1 and 10 billion $/€, small firms have revenues under 1 billion $/€.

A structured interview format was used to gather data. Open-ended questions (available upon request) were developed to examine types of purchases, risk assessment and price risk mitigation strategies. Data were gathered in face to face or phone/videoconferencing interviews which lasted about one hour each. The interview questions were shared with each respondent prior to the interview.

In each company, after gaining agreement to participate, the first step was to conduct an interview with the Chief Purchasing Officer (CPO) or Director-level or above supply management professional. As part of the interview, these respondents were asked to identify one or two knowledgeable key informants who were responsible for managing price risk for direct purchases (e.g., raw materials) or for other commodities purchased in their value chains from suppliers or other parties. The interviews were audio recorded and transcribed. Participants reviewed the transcripts and minor changes were made by four individuals (Rubin and Rubin, 2011). A report summarizing the findings was shared with all participants. We also gathered secondary information about each company before and after the interviews which provided context for the responses (Miles *et al*., 2014).

3.2 Data Analysis

The unit of analysis is the firm's methodology for assessing commodity price risk and developing price forecasts. Following the approach by Strauss and Corbin (1998), data were open coded by the researchers to confirm that the IPT processing steps 1) acquiring information, 2) interpreting information, 3) distributing information, and 4) creating shared meaning were the appropriate categories. This was followed by axial coding, grouping codes into broader, more inclusive codes (Margolis and Molinsky, 2008; Isabella, 1990). The process allowed us to identify risk assessment components and potential causal relationships. The coded interview protocols were regularly triangulated among the group of researchers to ensure inter-rater reliability (Armstrong *et al*., 1997) and there was an initial inter-coder reliability rate of 90%. The researchers discussed and resolved differences in application and interpretation of coding. In the next step, selective coding, we identified dominant themes that emerged from the data.

4. Findings

The research findings of how firms assess commodity price risk are organized along the four steps of 1) acquiring information, 2) interpreting information, 3) distributing information, and 4) creating shared meaning. A summary of evidence in each of these areas is summarized in Table 2.

Table 2. Summary of Findings

Code	Standardized Process	Acquiring Information	Interpreting Information	Distributing Information	Creating Shared Meaning	Primary Risk Mitigation Strategy
PASTA	Yes	Market indices Supply market research gathered by buyers all over the world Informal discussions with suppliers	Value at Risk Monte Carlo simulation	Internally within supply management Externally with suppliers	Determine sourcing regions Input into budgets Length and amount of financial hedging	Financial hedging
FLY	No	Market Indices External service providers	Managerial judgement	Internally within supply management Externally with suppliers and customers	Input into budgets Timing of supplier negotiations and length of contracts	Contractual agreements with customers
CHEM	No	Market indices Informal discussions with customers and suppliers around the world	Managerial judgement	Internally within supply management Cross-functional with business unit	Determine sourcing regions Determine amount of spot buys versus contract coverage	Adjusting volume under contract versus spot buys
CAR	Yes	Market indices External service providers Informal discussion with suppliers General market trends	Managerial judgement	Internally with supply management Internally with cross functional executive board	Input into budgets Long term planning	Contracts with prices tied to indices with suppliers
CHOC	No	Market indices Informal discussions with suppliers General market conditions	Quantitative pricing simulations Managerial judgement	Internally within supply management Externally with suppliers	Input into budgets Financial hedging	Financial hedging
ELEC	Yes	Market indices Formal, in-depth supply market research	Quantitative pricing model Managerial judgement	Internally within supply management and with finance	Input into budgets Timing of supplier negotiations and length of contracts	Financial hedging

		Informal discussions with suppliers				
COFF	Yes	Market indices Supply market research gathered by buyers all over the world	Managerial judgement	Internally within supply management Cross-functional with business unit and finance	Length and amount of financial hedges	Financial hedging
INTG	No	Market indices External service provider General market conditions	Managerial judgement	Internally within supply management Externally with suppliers	Contract length and timing	Contract timing and length with suppliers
EQUIP	No	Market indices Market service providers Industry conferences	Managerial judgement	Internally within supply management and with finance	Input into budget Determine contract escalation	Contracts with escalator clauses with suppliers
PACK	No	Market indices Informal discussions with suppliers	Managerial judgement	Internally with executive team Externally with customers	Input into budgets Modeling to determine pass-through prices to customers	Contracts with prices tied to indices with customers
VEICL	No	Market indices Informal discussions with suppliers	Managerial judgement	Internally within supply management	Input into budget Cost and margin analysis Determine contract escalation	Contracts with escalator clauses with suppliers
CONS	Yes	Market indices Formal in-depth supply market analysis	Fundamental analysis and econometric models	Internally within supply management Senior level executive team Externally with customers and suppliers	Length of financial position and types of trades	Financial hedging

The evidence suggests four of the companies in the study have standardized processes for assessing commodity price risk. With the exception of EQUIP, evidence suggests that standardized processes are used for commodity risk assessment by the larger companies in the study. Two of the larger companies, ELEC and CON have an established centralized supply market research group responsible for gathering and analyzing supply market data. In both of these cases, spend on commodities is 50% or more of the company's overall spend. PASTA, a medium sized company, whose commmodity purchases account for 45% of its costs, also uses a standard assessment process. However, rather than creating a centralized process, it uses a team of globally dispersed buyers to gather price risk information. The process at COFF, which did not disclose its spend ratios, is also standardized.

4.1 Acquiring Information

All the companies in our study monitor external data sources with respect to the key commodities they directly purchase. However, the level of aggregation and data sources, which include published market indices, external service providers, broad economic and market data, and informal discussions with suppliers and customers, differ by company. To assess commodtiy prices, all the companies monitor commodity prices reported by market indices relevant to their commodities on commodity exchanges such as NYMEX, LME, ICE, and CME or industry indices such as American Metal Market and ICIS (chemicals). Three companies (CAR, FLY, and INTG) report using supply market intelligence services such as IHS Global Insight and the Commodity Research Unit (CRU) to forecast prices. The supply executive of CAR explained why they used external sources rather than developing commodity forecasts internally:

> *"We rely on the data coming from service providers and (…) consolidate the forecasts of various banks e.g. and use the average for each commodity. Of course, we would have people who are capable of creating such a forecast, but they do also not have the magical crystal ball and therefore we do not spend additional energy and money to create forecast."*

However, some organizations noted that in specific sectors the data provided by these service providers may not always be accurate. This is the case of FLY, for some certified high-quality materials for avionics, or in some emergent countries. The supply manager of EQUIP for example explained:

> *"I do use some forecast services ... You can pay a lot of money to companies that will forecast crude oil for instance or even natural rubber you can buy forecasts. I've done most of my own. I've found that some of the services that we use - and the volatility that we see in the raw materials markets – the services haven't been very good."*

Seven of the companies in the study use informal discussions with suppliers to gather information to assess commodity prices: PASTA, CHEM, CAR, CHOC, ELEC, PACK, and VEICL. PACK, for example, collects and integrates information from a variety of primarily resin suppliers and incorporates this with market price data.

The CPO of CHOC explained how they use information provided by suppliers:

"They (suppliers) know the markets very well. But we never rely on the opinion of a single supplier, we take the views of all suppliers. Further, we use neutral sources. All that plus our own feeling for the markets goes into our strategy process."

VEICL relies on suppliers for information about the steel market but does not use them as a source of information about aluminum. The commodity manager of VEICL explained:

"We look for trends, look to see if there's anything we can apply. Most of the time we do try to just factor in for some percentage increase, just so that we have that forecast for material increases in our budget."

For some companies, such as INTG and COFF, collecting data about steel requires going beyond the first tier in the supply chain. This is the case of INTG, because the price for steel is influenced by what is occurring at the mills with regard to lead times, due to longer lead times serving as an early warning indicator prices may be increasing. COFF also moves beyond its first tier suppliers, collecting information from local coffee traders in the countries from which it buys coffee.

Three companies in the study (PASTA, CONS, and ELEC) acquire primary data using specialized commodity research teams and develop their own price forecasts. PASTA has buyers located in supply markets across the globe to gather data on durum wheat production and uses suppliers as a primary source of price risk information. CONS's buyers work with suppliers to understand market availability and pricing of the fresh commodity raw materials to develop these forecasts. These raw materials are not traded in exchanges so market prices are not accessible.

The direct purchases commodity manager of PASTA said:

"The market of durum wheat is complex, and we need a strong market intelligence. For this reason, we have buyers that operate all over the world in order to know what's going on in those areas and to define which is the best strategy for our needs."

The executive of ELEC said:

"Our purchasing colleagues are clearly closer to the market. The HQ-analysts deliver valuable information but in bilateral talks with the suppliers, you learn more than what you can read from the reports – the general sentiment, patterns you have seen before in this market or elsewhere in the business."

4.2 Interpreting Information

After acquiring information, data must be analyzed and processed in order to make good decisions based on data (Daft and Weick, 1984). Four of the companies, PASTA, CHOC, ELEC, and CONS develop quantitative forecasting models or simulations to assess commodity price risk using financial hedging as their primary risk mitigation approach. The only other company in the study that primarily uses financial hedging, COFF, does not use quantitative approaches for risk assessment.

PASTA has developed a price risk assessment model that is based on Monte Carlo simulation and a Value at Risk (VaR) model, integrated with an internally developed price forecasting model, statistically correlating volumes, quality, demand and stock variables within four different "budget

times." In addition, CONS's buyers develop for each major commodity a "play-book" based on the information and forecasts provided by the procurement group. These documents describe the buyer's risk assessment and mitigation strategy and are constantly updated, supporting daily communication between buyers and CONS's procurement group analysts.

The executive of ELEC stated:

> *"The individual commodity manager is responsible to gather further information for the relevant markets – that is prices but also information on individual companies. We call the result of that exercise a material group strategy."*

Interpreting information can be complex because some commodities, such as certain agricultural commodities or metals, are interlinked with each other in terms of price variations. This presents a significant level of complexity due to different factors, such as interactions with currency rate valuations, relationships with different materials and financial speculation. For example, CHOC and FLY have experienced this combination of commodity and currency risk.

Similarly, the supply manager of CONS said:

> *"In the bigger corn, wheat, soybeans, they're very interconnected and so that we know one drives another. And they're also very big exposure items for us. So we spend a lot more time and create very similar (forecast) analysis weekly or monthly about all of those."*

The CEO of CHEM also declared that fluctuations of currencies in international markets often absorb the price variations of raw materials. Many commodities are related to other raw materials in the value chain. This is the case we found in our analysis with steel (with coke and iron ore), alloy (with manganese and chrome), and propylene and ethylene (with crude oil).

Most of the companies predominately use managerial judgment to assess price risk as is the case in CHEM, COFF, INTG, EQUIP, PACK, and VEICL. When using judgement, respondents highlighted how experience is relevant when analyzing data. Dane and Pratt (2007) describe how intuition can influence judgments and their applications to managerial decision making. The results are consistent with this line of research showing the more knowledge chain members possess increases information acquisition, and the greater their awareness, in conjunction with good information processing and experience, can ultimately enhance supply chain outcomes (Hult *et al*., 2004). As Hult *et al.* (2004) states: "Members of chains that possess significant memory are aware that knowledge coordination across nodes reduces duplication, waste, and redundancy". The CEO of CHEM highlighted:

> *"We listen at what markets and suppliers say to make an analysis and to elaborate internally our strategy … but these are primarily sensations. In fact, to take good decisions we need experience."*

The supply manager of INTG said:

> *"We're doing pretty good, outguessing where the market's going. And it just comes from – I don't know – years of experience and just talking to a lot of people and just kind of taking a lot of things into account."*

Besides the use of qualitative or quantitative tools for information analysis, many respondents (PASTA, CHEM, CAR, CHOC, ELEC, INTG, PACK, CONS) adopted the word "feeling" to explain the role and effectiveness of an intuitive information processing approach (Carter *et al*., 2017; Dane and Pratt, 2007). The direct purchases director of PASTA – for example – highlighted that experience is essential to understand all the influencing factors that lead to commodity price fluctuations. For example, buyers know that the quality of the harvest, in each region, will differently influence durum wheat price dynamics.

The executive of ELEC said:

> *"The key ingredient for our perfect meal is experience or intuition. It is not one or the other, both come together and help us form an opinion."*

The level of experience increases time by time, leading to better forecasts, as explained by the purchasing director of INTG:

> *"So we're going to continually do it a better and better, more refined job at understanding what that is but also forecasting it. So I just think we're going to increase our level of sophistication in forecasting some of those key raw materials."*

Only two of our study participants, FLY and CAR, do not analyze data in the forecasting process. FLY, in fact, relies upon service providers and key players in the supply chain (large scale assemblers) for price forecasts. CAR internally collects all the data about price dynamics, particularly regarding physical supply dynamics and needs for demand reduction. Then the company requires that its suppliers report on the role and importance of each raw material group, with external service providers interpreting the data.

4.3 Distributing Information

Information about price risk can be distributed internally within the organization and externally with suppliers and customers. Consistent with previous research, all of the managers in our study regularly discuss trends and price risk within internal functions through interdepartmental meetings (Jaworski and Kohli, 1993). In the purchasing function of PASTA managers explained the information sharing across purchasing managers of different geographical areas:

> *"We usually have weekly meetings, all together, also involving the area managers of Italy, Europe and the rest of the world. We meet every week to discuss about the (price) situation in the market, and to take decisions."*

In CONS, the commodity manager highlighted the role of internal functions and meetings:

> *"we are asked to provide a long-range kind of plan or forecast to our businesses in terms of what we view to be inflation. And typically, that is done internally, around fiscal year."*

ELEC and COFF also share commodity price information with finance. The key role of Finance in cross-functional meetings is described by the commodity manager of COFF:

"For every BU, we have a monthly commodity review. This is when the commodity group presents their fundamental analysis for each commodity and gives a recommendation for coverage. On the other side of the table you have the BU, CPO, CFO and the people who actually do the negotiations and contracting. But those meetings are largely dominated by finance, as finance knows best the marginal risk and the price risk."

Also, the purchasing director of INTG said:

"There's lots of opportunities in all procurement organizations to be much more sophisticated from a financial assessment, whether it's breaking down a supplier's cost to developing forecasts to whatever it may be. I just think there's some real opportunities there."

Further, an executive in ELEC explained:

"Our Supply Market Intelligence model is really good. A key thing is that all the buyers and other colleagues (e.g. from finance), they all use the same figures. This brings consistency or alignment and more fact-based discussions. So this consistency helps us making decisions faster. By the way, we share the indicators and forecasts with our buyers and with the businesses, but not with our suppliers."

CAR, COFF and CONS typically form internal, cross-functional teams composed of procurement managers, buyers, chief procurement officers, and sometime financial officers. In those cases where results are shared within larger cross-functional groups, involving parties such as research-and-development (R&D) officers, sales managers, and operations managers, interviewers state their capability to make good forecasts represents a competitive advantage.

However, only some of the case study participants share forecasts with suppliers, such as in the food (PASTA, CHOC, INTG and CONS), manufacturing (EQUIP) and aerospace industry (FLY) in our study, where companies share their information with suppliers for validation and as part of the negotiation process for purchasing contracts.

In CONS, the Vice President of World Wide Sourcing explained:

"Those cost estimates will be shared with our customers and the divisions so that they can build their margin forecasts and manage their margins going forward. (…) – (about suppliers): we will discuss, because I mean really over time, it is our desire to have a win-win relationships."

Similarly, the supply manager of EQUIP said:

"(we share our forecasts and) they share with us their view of the market – what they are hearing from other OEM's and it is very collaborative environment. We have done that – we get a lot of positive feedback from companies because we share pretty openly and transparently how we plan our business so that they can plan their capacities."

A win-win strategy is also presented by the supply manager of INTG:

"we've done is if it's a money-saving idea and we share those savings with the supplier. So it's kind of a win-win for both parties."

Most direct and second-tier suppliers regularly run their own forecasts, which increases the general level of knowledge and quality of the bilateral talks, resulting in more competitive negotiations.

The Direct purchases manager and the CEO of CHEM highlighted that they don't share forecasts with suppliers, but:

"It is very difficult to share an (effective) forecasting model, we need to talk to the customers and suppliers around the world, listening to the big players, important managers that know very well the market, so there are not techniques, it's a feeling.

From a different perspective, CAR's raw materials manager linked a good analysis of raw material price, and cost transparency, to a (better) control of supplier relationships:

"It was all about transparency: Which price risks do we have then? Where can we use indexes? All these things helped us to get the supplier relationships back under control. We have isolated the price volatility from the normal purchasing negotiations, the supplier negotiations, the price negotiations. We have annual price negotiations that focus again and more or less only on the value creation of the supplier, the ratio potential, streamlining the production processes."

In the value chain, the visibility at the second-tier level is even more limited. The commodity manager of non-ferrous commodities in ELEC explained:

"Today, steel prices or rather the cost structures of steel are largely intransparent. But the grey zone is not 40%, no, we can pretty reliably calculate 80% of their costs, we are not totally blind."

Sharing information with customers was not discussed in the study with the exception of FLY, PACK and, partially, CONS in the case where commodity prices were passed through to the customer as part of the contract.

4.4 Creating Shared Meaning

According to Huber's (1991) definition of shared meaning, companies in our study develop a shared understanding of the available information and implications of commodity price dynamics to provide input into the budgeting process, to make sourcing decisions, to determine contract length and timing, to decide upon the amount for spot buys, and to determine hedging strategies. The results from the risk assessment process are used to derive a comprehensive purchasing strategy and for budgeting purposes. To develop a shared meaning, reconciliation frequently involves intense discussions between modelers, commodity buyers, and other officers to ultimately create a better decision-making process and ideally a better result.

For example, the purchasing director at FLY stated:

"Our goal is to respect our forecast, the budget."

The CPO of CHOC confirmed that the price risk assessment is primarily used to define the budget, and added:

"….We have a (price) risk related to the market. But once we have made our budget, we have a second risk – the risk relative to our budget! (…) How do we measure our success? Relative to our budget."

For the VEICL's commodity manager the understanding of commodity price risk dynamics is related to a cost and margin analysis:

"The base price is set through cost breakdown. We would break down the actual total cost by raw material and then the conversion and then margins and then logistics and all of that. So in order to start the process, we need to know the "cost confidence" of the product."

Also, the purchasing director of PACK linked the risk forecast to issues related to cost and budget, but adopted the extended perspective of big retailers downstream in the supply chain, saying:

"So they (big retailers) really need to understand what their cost exposure is for the year so that they can make their budget assumptions."

In CAR, the supply executive highlighted their cost-transparency orientation:

"Our focus in on cost transparency. We have hundreds of cost engineers who calculate our products. This approach of transparency in terms of the value added absolutely requires that you challenge all objectively measurable cost positions of your raw materials."

For a supply management executive at ELEC, shared understanding of price risk should primarily lead to fast decisions:

"The greatest challenge for our company when managing price risk? Being fast. Why, time is money. It is really that simple."

Time is also a key-measure for COFF, since a commodity manager stated:

"We know the delay between the time when the commodity price changes and when we can change our prices: it is nine weeks – that is what you always have to cover."

The focus on costs, from a supply chain perspective, is explained by the commodity manager of CONS:

"They (suppliers) have to share with us what the raw product cost consideration is and for – in the example I used – tomatoes – it is pretty easy because it is very transparent not only to us but to the whole industry."

At the same time, the supply chain manager of CONS takes a supply chain wide perspective by saying:

> *"We use them (forecasts) to communicate kind of exposure to the market for places that we are not hedged and what the risk and opportunity could look like in those future years. And for places that we are hedged, we use that as a benchmark to say we're favorable versus the market or unfavorable versus the market."*

5. Discussion and managerial implications

For all the organizations in our study external information acquisition is the key step in the risk assessment process, because it influences the approaches adopted for information interpretation and distribution. However, there are key differences in the type of information, which affect information interpretation and distribution. Three of the organizations (PASTA, CONS, and ELEC) have the most sophisticated information processing processes for assessing commodity price risk. They have standardized processes and gather large amounts of primary data on supply and demand and then internally analyze these data to develop a forecast using quantitative tools. COFF and CHOC appear to have the next level of information processing capabilities. COFF uses a standardized process, gathers and processes primary data but uses managerial judgement for forecasting. Information processing is not standardized at CHOC, but primary data are gathered and quantitative pricing simulations are used along with managerial judgement to develop price forecasts. Both COFF and CHOC engage in financial hedging. CAR also uses a standardized process and gathers information from both primary and secondary sources but relies on managerial judgement for forecasting and does not engage in financial hedging. The remaining companies have capabilities to assess commodity price risk, but their processes are not standardized. In addition to market indices, the other companies use external service providers, informal discussions with customers and suppliers, or general market trends for information gathering, and then use managerial judgement to interpret risk information.

What factors drive PASTA, CONS, and ELEC to have more developed information processing of commodity data than other companies in the study? According to IPT, organizations which face greater consequences from exposure to the uncertainty from commodity price risk would be expected to increase their information processing capabilities to reduce uncertainty. We examined company size, spend, and choice of risk mitigation factors for potential relationships. Company size could be a factor because larger organizations will likely have more resources to invest in commodity price risk assessment. However, although two of the companies are large (CONS and ELEC), other large companies in the study do not have the same level of information processing capabilities.

For PASTA, CONS, and ELEC, price volatile commodities account for 45% or more of spend, suggesting effectively managing commodity price risk is an opportunity for cost savings. This may be especially important for PASTA, CONS, and CHOC, who are facing increasing competition in the low margin food industry. COFF is also in the food industry, although the nature of their products and strength of their brands many not expose them to as much margin pressure. However, at INTG, CHEM, and PACK the spend percentage on commodities is similar. Further, CHEM and PACK are in low margin businesses. Thus, having a large enough spend is

likely to be a necessary, but not sufficient criterion for driving the development of information processing capabilities.

The results suggest the complexity of the primary risk mitigation strategy used by the organization may also be a factor in the development of information processing capabilities. Companies use sourcing strategies (such as supplier switching or purchasing timing), contracting strategies (such as escalator clauses or passing price increases to customers), and financing strategies (Gaudenzi *et al*., 2017) to mitigate commodity price volatility. PASTA, CONS, and ELEC extensively use financial hedging to mitigate price risk. Financial hedging is a complex process that involves making decisions not only about the physical commodity but also about the timing, volume, and types of transactions of financial trades. Financial hedging likely increases uncertainty and the need for information processing as suggested by IPT (Tazelaar and Snijders, 2012; Tushman and Nadler, 1978; Galbraith, 1973, 1974). Thus, organizations that rely heavily on financial hedging to mitigate price risk may need to invest more to process information in assessing commodity price risk. Price risk information is essential for making hedging decisions. However, COFF, which also uses financial hedging, does not employ quantitative methods in their analyses. This may be in-part because there are significant differences in the types and flavors of the coffees in the different regions of the world where they source green coffee beans making the use of quantitative modeling more difficult. CHEM and PACK can pass cost increases or decreases on to the end consumers as part of their contractual agreements; thus they only need to know actual market prices or the agreed upon index. Their customers are exposed to the uncertainty from commodity price volatility.

Assessing commodity price risk is a complex task and interpretation typically is done by teams, rather than individuals. All companies in the study use a cross-functional approach to interpret information. During interpretation, teams carefully analyze relationships among different materials, financial speculation, and other external factors to decide upon risk mitigation strategies. From our findings we observed commodity price risk should include the input from multiple business functions, using cross-functional teams to incorporate numerous perspective and create a more holistic assessment for better guiding managerial decisions. However, our findings do not allow us to deeply understand which is the optimal design and extent of a cross-functional risk assessment process.

Our results suggest that when risk assessment is based on several inputs, sophisticated interpretation models, and is shared across different teams, it leads to better decisions but may also be time consuming. In parallel, several respondents highlighted how expert analysts and decision makers use their intuition for understanding complex connections among several decision variables, and getting faster decisions. This evidence suggests that past experience and intuition are capabilities that can make sophisticated risk assessment processes faster and more effective. Thus, the sense of urgency in making decisions based that would be affected by price volatility may affect the design of the assessment process.

The amount of knowledge, experience, and familiarity with risk assessment is defined by Hult *et al.* (2004) as "achieved memory". Similar to the findings of Dane and Pratt (2007) and Carter *et al*. (2017), several respondents (PASTA, CHEM, CAR, CHOC, ELEC, INTG, PACK, CONS) have long-term experience purchasing price volatile commodities, and use intuition when

interpreting information about risk. This experience seems to lead, in the perception of the respondents, to the capability for understanding complex connections among several decision variables, and hence resulting in faster and better decisions about risk mitigation strategies. In a supply chain context rational approaches and intuition can complement each other (Carter *et al*., 2017). For example, in supplier selection, the interaction between intuition and rational decision-making is positively related to supplier performance (Kaufman *et al*., 2017). Future research can explore roles and effectiveness of intuition and analytical approaches in assessing and mitigating supply chain risk.

When there is less visibility in a commodity market, for example, when market prices are not publicly available or trusted, companies depend upon suppliers and upstream supply chain members as sources of information (Roehrich *et al*, 2014). Thus, it is likely the supplier relationships are more important for information acquisition and interpretation for some commodities than for others. Even in markets when price data are visible, companies informally use suppliers as a source of price risk information. However, in our study we found only some companies share their price forecasts with their suppliers, suggesting that even though companies profess to have close supplier relationships, the lack of trust may still be a barrier to effectively assessing and mitigating commodity price risk.

Looking downstream in the supply chain, information sharing is rarely a reality. This may be a lack of trust with how price risk information would be used by customers. When contractual agreements with customers require price adjustments, assessment information is shared. For example, this occurs in the aerospace industry, where there are several cases of customer-driven risk assessment polices that have the goal of increasing the efficiency of supply chain risk mitigation strategies, particularly in terms of contracting strategies. CHEM and PACK also share actual price data with customers as part of contractual agreements, allowing them to pass price increases or decreases directly to customers.

6. Conclusions and future research directions

Commodity price risk is a reality in today's supply chains. Commodity price risk requires firms to first thoroughly assess their exposure to price volatility before determining if and what approaches should be considered for best mitigating this threat to profitability. Our study shows companies use different approaches for assessing commodity price risk and some organizations have more developed information processing capabilities than others. The key difference appears to be in the investment in internal resources to acquire and interpret information. Three companies, PASTA, CONS, and ELEC have the greatest information processing capabilities. This is likely influenced by the reliance on financial hedging as a risk mitigation strategy by these companies. The sense of urgency in making decisions may also influence the information interpretation process. When time is critical, organizations may depend upon experienced experts rather than teams for interpreting information. Trust of appears to influence information dissemination within the supply chain, especially with customers. However, additional empirical research, such as a survey, is needed to confirm the relationship of these factors with the commodity risk assessment information process.

There are several limitations with our research. The case study approach limits our ability to confirm relationships among the constructs. A large-scale survey would allow for relationships to be confirmed. In addition, future research could investigate the role of intuitive information process management and decision-making approaches compared with analytic, rational and formalized processing (Carter *et al*., 2017; Dane and Pratt, 2007). Another limitation of our research is that we did not explore the effectiveness of the different risk assessment approaches. Future research should focus on relating performance outcomes to the commodity price risk assessment process. Further, we focused only on one phase of the price risk management process. Future research should take a holistic view of all stages of risk assessment and mitigation processes from a portfolio theory or real option perspective. Future research could also further investigate the level of sophistication, complexity and cross-functionality the information process should have in order to assure the best risk assessment outputs, at the most reasonable cost for the organization. Fuzzy set Qualitative Comparative Analysis (fsQCA) could be used for interpreting qualitative data and evaluating the potential relationships between 'predictors' (such as firm characteristics) and an outcome (such as the effective and efficient price risk assessment model).

To our knowledge, there are only a few studies explicitly examining how firms can assess and mitigate commodity price volatility from a supply chain perspective. Our exploratory research provided a starting point for future empirical studies. We believe more research is necessary for understanding the role of the supply chain function in helping firms to create greater predictability in the price paid for commodities.

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The impact of social capital and power on information sharing

Cees J. Gelderman[a]

Ellen R. Peeters[b]

Janjaap Semeijn[c]

Ferdi Ter Avest[d]

[a] corresponding author, Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762590, e-mail kees.gelderman@ou.nl

[b] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762757, e-mail ellen.peeters@ou.nl

[c] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762588, e-mail: janjaap.semeijn@ou.nl

[d] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31880546014, e-mail: f.teravest@zwanenburg.nl

Abstract

Competition between companies has evolved into competition between supply chains. Buying companies increasingly recognize the need to cultivate relationships with their suppliers. Maintaining these relationships is highly dependent on sufficient information sharing between suppliers and buyers. We investigate the influence of social capital and buyer power on information sharing. A survey of first tier suppliers in the Dutch meat processing industry was carried out. The data from 82 suppliers was analyzed using Partial Least Squares. It appears that relational social capital has a direct influence on information sharing. Both cognitive and structural social capital have a direct effect on relational social capital, while expert power has an indirect effect. Coercive power showed no influence at all. Implications are provided. Buying companies can encourage supplier information sharing by building up their own expertise and cultivating social relationships.

Key words: information sharing, social capital, expert power, coercive power

Category: competitive paper (IPSERA 2018)

1 Introduction

Recent developments such as global competition, globalization and rapid response to customer needs are redefining business as usual. One of the changes is the new focus on competition between supply chains instead of competition between firms (Hsuan, Skjøtt-Larsen, Kinra, & Kotzab, 2015). An organization is highly dependent on its connections with other organizations in a supply chain. A supply chain is a concept of closely coordinated, cooperative networks, competing with other networks (e.g. Chuang, Chen and Lin, 2016). The competitive focus has led to the requirement of new management skills in terms of developing inter-organizational relationships with strategic partners (Hsuan et al., 2015). Inter-organizational relationships will improve integration between organizations, where integration can help companies to coordinate central processes, create cost savings and improve firm performance (Flynn, Huo, & Zhao, 2010). Information sharing is a key component in these inter-organizational relationships (Carr & Kaynak, 2007).

Information sharing refers to the exchange of critical information that facilitates inter-firm collaboration among supply chain members (e.g. Zhou and Benton, 2007). Numerous benefits have been linked to information sharing (cf. Sahin and Robinson, 2002), even sizeable advantage over competitors (e.g. Liu et al., 2013). Shared information will lead to cost savings through inventory and batch size reductions (Marshall, 2015), improved forecasts and reduced inventory levels (Lee et al., 2000), improved inventory control (Costantino et al., 2014), and the mitigation of the bullwhip effect and improved inventory variance (Costantino et al., 2015). Information sharing contributes to a better performance of the logistic system in terms of time, quality and speed (e.g Hsuan et al., 2015).

Information sharing in supply management has been extensively studied for decades (for an overview, see Marshall, 2015 and Kembro, Selviaridis and Näslund, 2014). Despite the recognized benefits, many firms seem reluctant to share information with their supply chain partners (e.g. Olorunniwo and Li, 2010). A barrier to information sharing are concerns about trust and confidentiality (Li and Lin, 2006). A fear of unequal distribution of risks and returns is likely to hinder information sharing (cf. Li et al., 2014; Manatsa and McLaren, 2008). Power and dependence are generally considered important for the understanding of buyer-supplier relationships (e.g. Cox, 2001). A high dependency asymmetry may be detrimental to information sharing, while powerful companies could impose on supply chain partners which information is required (e.g Vijayasarathy, 2010; Yigitbasioglu, 2010).

Literature on information sharing recognizes the importance of social relations between buying and supplying companies (e.g. Li et al., 2014). Social capital theory has become a useful theoretical lens for examining buyer-supplier relationships (e.g. Gelderman, Semeijn and Mertschuweit, 2016). Social capital refers to the resources that are available through networks of relationships (Nahapiet and Ghoshal, 1998). Social capital is being recognized as an important concept for examining information sharing practices (cf. Matthews and Marzec, 2012; Yim and Leem, 20130). However, the impact of social capital on information sharing is hardly investigated, with Li et al. (2014) as a notable exception.

Nahapiet and Ghoshal (1998) propose three dimensions of social capital: a cognitive dimension (sharing meaning and understanding between actors), a structural dimension (the frequency of

interactions and contact between actors), and a relational dimension (referring to trust, friendship, and respect). Li et al. (2014) hypothesized that the three dimensions all directly impact the information sharing content and quality between a manufacturer and its major supplier. However, there is strong evidence that the three social capital dimensions should not be handled as independent variables (Gelderman et al., 2016). Instead, there is substructure in these dimensions in which cognitive and structural social capital are antecedents of relational social capital (e.g. Carey et al., 2011; Horn et al., 2014; Roden and Lawson, 2014). To the best of our knowledge, no previous studies have investigated the substructure of the three social capital dimension and its impact on information sharing. The main research questions of this study are: what is the direct effect of (the substructure of) social capital dimensions on information sharing? And: what is the indirect effect of (buyer) power on information sharing through these social capital dimensions?

The purpose of the study is to investigate the role and the importance of power and social capital dimensions in the context of information sharing. Our study contributes in several ways to the current body of knowledge. First, our study enhances knowledge by investigating the influence of (all three dimension of) social capital on information sharing. Second, instead of handling the three social capital dimensions as independent variables (cf. Li et al., 2104), we have developed a conceptual model which includes a substructure for the dimensions that is well-grounded in previous studies. Third, this study extends previous research by examining the role of power in the mechanisms that produce information sharing. Power is an often overlooked concept in information sharing studies. Our study investigated the interplay of power, social capital and information sharing in buyer-supplier relationships.

The remainder of this paper is structured as follows. Hypotheses and a conceptual are developed and derived from literature on social capital theory, power and information sharing. The conceptual model is empirically validated using data from a survey among the first tier suppliers of a large Dutch deli meat producer.

2 Literature review and hypotheses development

2.1 Information sharing in the supply chain

All companies need information to cope with the uncertainties in their business environment (Stern and Reve, 1980). A generic definition of information sharing is "the degree to which each party discloses information that may facilitate the other party's activities" (Heide and Miner, 1992, p. 275). Within the context of interfirm collaboration, information sharing refers to the exchange of data, information and/or knowledge between supply chain parties (Kembro and Näslund, 2014). The literature generally supports the notion that effective exchange of critical information facilitates interfirm collaboration and that it can provide a strategic advantage over competitors (e.g. Li et al., 2014). Information sharing with supply chain members includes the exchange of information on operations management (e.g. material flow, order entry, shipping, billing) as well as the exchange of forecasts and plans (Marquez, Bianchi and Gupta, 2004). Undistorted, accurate and up-to-date information is useful for making decisions on production, inventory and logistics management (Bargshady et al., 2016) which is a critical factor in the success of supply chain performance (Zhou and Benton, 2007). Many studies have provided evidence that information sharing contributes significantly to the mitigation of the well-known

bullwhip effect (e.g. Wu, Chang and Hsu., 2014; Costantino et al., 2014). Despite the many important benefits of information sharing, more skeptical views point at the downsides and the limited advantages due to complexities and costs (e.g. Tran, Childerhouse and Deakins, 2016). Risks include a loss of power and/or competitiveness (e.g Uzzi and Lancaster, 2003: Kembro and Näslund, 2014).

Studies have argued the need for advanced information technology to exchange supply chain information (e.g. Li et al., 2014). The Internet and EDI are primary vehicles that drive electronic transactions and information sharing (Marshall, 2015). Poor data quality and a lack of shared information will result in costly repercussions and operational problems (Tran et al., 2016). Confidence in the security and quality of information systems impacts the willingness and capability of companies to share confidential information (Zhang and Li, 2006). However, appropriate information technology is not a sufficient condition for companies to engage in information sharing (Li et al., 2014). Relational factors are important too in explaining the involvement of firms in the exchange of (confidential) information (e.g. Fawcett. Ellram and Ogden, 2006). A social exchange perspective appears promising for examining information sharing practices in the supply chain (Wu et al., 2014).

2.2 Social capital and information sharing

Social capital theory has its roots in sociology and political science where it describes and explains the preferential treatment and cooperation between individuals and groups (e.g. Putnam, 1955). Social capital is referred to as a valuable asset that stems from access to resources made available through social relationships (Nahapiet and Ghoshal, 1998). Social capital theory has become a useful theoretical lens for examining buyer-supplier relationships (e.g. Gelderman et al., 2016). Studies have reported the beneficial effects of social capital operational performance in terms of costs, quality, lead time, flexibility, and delivery (e.g. Cousins, Handfield and Lawson, 2006; Lawson, Tyler and Cousins, 2008; Whipple, Wiedmer and Boyer, 2015). Other studies have included strategic benefits such as product innovation, market creation, technological development (e.g. Villena et al., 2011; Sanders, 2008; Terpend et al., 2008), and information sharing (Li et al., 2014).

In their seminal paper, Nahapiet and Ghoshal (1998) proposed three dimensions of social capital: a cognitive dimension which represents shared meaning and understanding between actors, a relational dimension which refers to trust, friendship, respect, and mutuality established by regular interactions between actors, and a structural dimension which refers to the frequency of interaction, the frequency of contact between the various departments in both organizations and the number of contacts between various levels within both organizations. These different dimensions can have different effects on information sharing and other performance measures (Gelderman et al., 2016; Li et al., 2014). Additionally, we assume specific interrelationships between the dimensions: cognitive and structural social capital are considered antecedents of relational social capital (cf. Carey et al., 2011; Horn et al., 2014; Rodenand Lawson, 2014).

Cognitive embeddedness between two actors was found to be positively associated with relational embeddedness, in that alignment between beliefs and expectations reinforces trust and commitment (Simsek et al., 2003). Cognitive social capital, as shared understandings, values and beliefs, is likely to breed trust (Carey et al., 2011). If parties have little understanding for one

another, relational capital is not likely to grow (cf. Adler and Kwon, 2000). With Roden and Lawson (2014), we expect that cognitive social capital has a positive impact on relational social capital. In addition, we propose a positive relationship between structural capital and relational capital as well. Structural social capital, as social interactions, facilitates the development of trusting relationships (e.g. Carey et al., 2014). Studies have shown that trust is developed through direct experiences and interactions with each other (e.g. Granovetter, 1985). Therefore, we propose:

H_2: Cognitive social capital has a positive impact on relational social capital.

H_2: Structural social capital has a positive impact on relational social capital.

Although the concept of information sharing has received increasing attention in academic literature, few empirical studies investigate the relationship between (dimensions of) social capital and information sharing. In the study of Li et al. (2014), cognitive and relational social capital appeared to have a positive impact on information sharing. In another study, it was found that structural, relational and cognitive social capital affect knowledge sharing, which in turn influenced organizational performance (Kim et al., 2013). Carlos and Pinho (2013) reported that trusted parties showed reduced feelings of vulnerability and as a result, they did not hesitate in committing and cooperating in a long-term relationship. In a related study, Willem and Scarbough (2006) found that trust and mutual understanding constitute the basis for higher approachability and improved communication, which fosters more intensive knowledge sharing. Obviously, with a lack of trust, parties will be unwilling to exchange sensitive information (e.g. Fawcett et al., 2007). Similarly, other studies reported a positive relationship between trust and information sharing (e.g. Li and Lin, 2006; Wang, Zha and Schuh, 2014). We expect:

H_3: Relational social capital has a positive impact on information sharing.

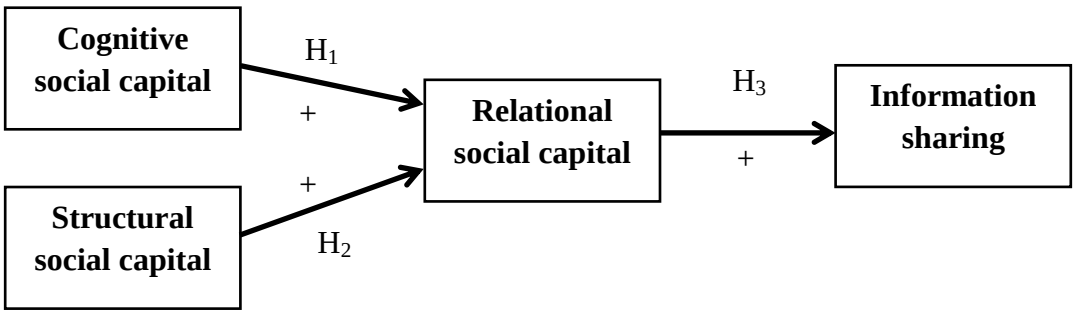

Figure 1 Social capital dimensions and information sharing

2.3 The influence of coercive and expert power

Considering the importance of social capital in buyer-supplier relationships, we need a thorough understanding of its drivers and barriers. However, little work has been done to explore the antecedents of social capital (cf. Chang & Hsu, 2016). In addition, the few studies on these antecedents focus on social capital on an individual level within organizations. An example is

Van den Hooff & Huysman (2009) who investigated the impact of organizational characteristics (e.g. organizational culture and structure) on social capital and knowledge sharing with colleagues.

The potential of including power in information sharing studies has been underplayed (cf. Kembro et al., 2014). The actual sharing of information by a weaker party is likely to be influenced by the power of the stronger party. In many industries, buying firms are able to dominate or even exploit their suppliers (Yigitbasioglu, 2010; Schleper, Blome and Wuttke, 2017). Large retail organizations initiate decisions, configure products and place orders that pull products through the supply chain (Hsuan et al., 2015). Therefore, customers and buyers are usually more powerful than the manufacturers and suppliers of goods (Huo, Wang, Zhao, and Schuh, 2016). Suppliers may be reluctant to share information due to perceived risks, costs and other downsides (e.g. Tran et al., 2016; Uzzi and Lancaster, 2003: Kembro and Näslund, 2014).

The Resource Dependence Theory has proved to be a useful perspective for understanding and studying buyer-supplier relationship. The main principle of this theory is that organizations need to get access to external resources, while trying to remain autonomous from other organizations (Pfeffer and Salancik, 1978). An often quoted definition of power is given by Dahl (1957, p. 202-203): " A has power over B to the extent that he can get B to do something that B would otherwise not do." A critical element in this definition is the ability of a party to impose his or her wills on others, to overcome resistance in achieving a desired goal or result. Resource Dependency Theory helps to explain why companies share or do not share information. A dominant company could, for instance impose on another company to share certain information (Kembro et al, 2014) or to use a certain information sharing mechanism (Yigitbasioglu, 2010).

However, there are contrasting views on the role of power in sharing information between buyers and suppliers. A dominant player can force weaker parties to share information. Buyer can use influence strategies in achieving compliance and cooperation from suppliers (e.g. Frazier and Rody, 1991). Another mechanism might be that dominated suppliers will try to refrain from sharing confidential and important information (Kembro et al., 2017). In a more positive vein, some studies found that power can provide an effective coordination of exchange relationships, promoting supply chain integration and performance (e.g. Maloni and Benton, 2000; Caniëls and Gelderman, 2010). How can we account for these paradoxical different effects?

The answer could be found in the multidimensional nature of power. Different types of power may have different effects. Dominant firms can have different power bases to influence a weaker party (French and Raven, 1959). Power types can be classified by their need for activation. Activated power types are based on intentional use, while passive power types are created by the perceptions of the other party and are hard to control directly (Reimann and Ketchen, 2017).

Superficially, it can be argued that the use power is incompatible with developing and maintaining collaborative relationships. The reality is more complex. Coercive power may only result in enforced compliance in combination with reduced levels of trust and social capital , since the impact is based on (the threat of) punishment. In contrast, expert power builds trust and could result in voluntary collaboration, (cf. Gangl, 2015). Recently, Chae, Choi & Hur (2017) found evidence for the distinct effects of coercive power and nonmediated powers, such as expert power, on supplier commitment.

Coercive power is a form of activated power. *Coercive power* includes promising rewards in case of compliance and threatening punishments in case of noncompliance (Benton and Maloni, 2005). This type of power use is based on the willingness to inflict negative consequences to noncompliance (Gundlach and Cadotte, 1994). Expert power is a typical example of a passive power type. *Expert power* is based on the appreciation of the other party's expertise (Benton and Maloni, 2005). Passive power types are likely to have beneficial effects on relationships, while activated power types can have detrimental effects (Huo, Flynn and Zhao, 2017). For instance, the threat or actual use of expert power in a supply chain increases cognitive social capital in terms of common interests as well as promoting collective goals and vision (Jonsson and Zineldin, 2003). The opposite is expected from the threat or actual use of coercive power (Chen, Zhao, Lewis, and Squire, 2015. We propose the following hypotheses:

H_4: Coercive power has a negative impact on cognitive (a) and structural social capital (b).

H_5: Expert power has a positive impact on cognitive (a) and structural social capital (b).

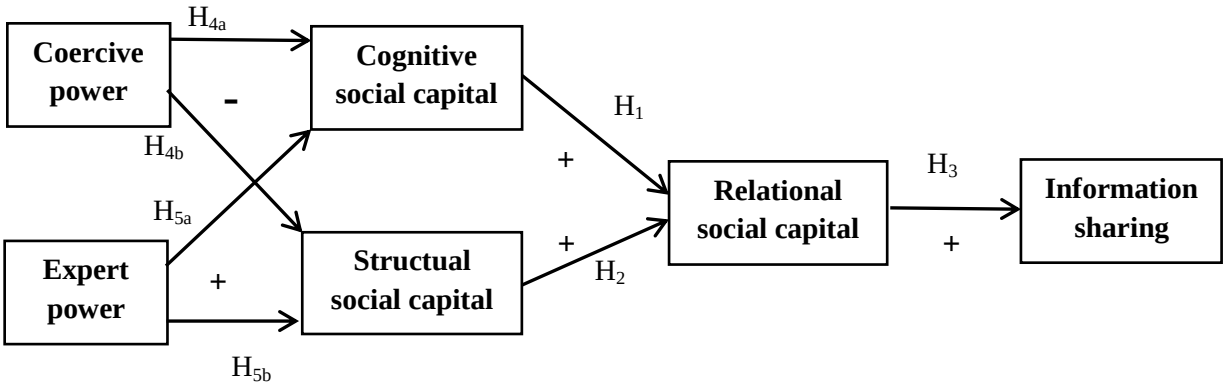

Figure 2 Conceptual model

3 Research method

Data collection took place through an electronic survey amongst a sample of managers employed at European food producing companies. To test the hypotheses, we invited suppliers of Zwanenberg Food Group to participate in the study. The Zwanenberg Food Group is one of the leading European producers and exporters of meat products and canned meat. Suppliers where selected on two criteria. The organization should be Dutch and it has to be a first tier supplier for Zwanenberg Food Group. A draft version of the questionnaire was pre-tested on a small number of respondents (pilot study).The final version of the questionnaire was administered online. After a week non-respondents received a kind reminder with the request to complete the questionnaire. The survey resulted in 82 useable responses.

To investigate the constructs, six variables were measured on 7-point Likert scales. These variables are information sharing, cognitive social capital, relational social capital, structural social capital, coercive power and expert power. To ensure that the respondent will take the time to read the questions carefully, there are questions with both positive and negative pronunciations (Saunders, Lewis, and Thornhill, 2012), which is important for the validity of questions measured

by a seven-point Likert scale (Dillman, 2000). The questions were translated into Dutch. Two translators executed the translation, one is a native speaker of the source language and one is a native speaker of the target language.

All operationalizations were derived from measurement scales used and validated in other academic studies and adapted to fit the context of this study. *Coercive power* was measured by using the four items adapted from from Brown, Lusch and Nicholson (1995). An example item is: "The major customer's personnel would somehow get back at us if we do not make changes in our research and development". *Expert power* was measured by four items adapted from Brown, Lusch and Nicholson (1995). An example item is: "Our major customer ensures changes in our research and development because we trust the customer's judgment". It should be noted that the operationalizations of the power constructs refer to the threat that emanates from the actual use of power. It is not about the actual use of power, but the imminent possibility that buyer power is exercised at the expensive of a supplier. *Structural social capital* was measured by three items derived from Villena, Revilla and Choi (2011). An example item is: "Our major customer and we do not have frequent and intensive interaction with each other" (reverse coded). *Cognitive social capital* was measured by four items derived from Li, Ye, and Sheu (2014) and Son, Kocabasoglu-Hillmer, and Roden (2016). An example item is: "Our major customer and we share the same vision". *Relational social capital* was measured by five items derived from Li, Ye and Sheu (2014) and Wu, Chuang and Hsu (2014), and Villena et al. (2011). An example item is: "Our major customer and we share confidential information with each other". *Information sharing* was measured by four items derived from Li et al. (2014) and Wu et al. (2014). An example item is: "We are willing to share our actual sales data with our major customer".

4 Results

A total number of 157 suppliers was first contacted by email, then the questionnaire was sent out electronically. After a follow up email, sent after two weeks, a total number of 82 questionnaires were completed, which results in an effective response rate of 52,3% (82/157). We included some background variables to get insight in sample characteristics. Company size was measured by questions about the number of employees and annual revenues in Euros. About 11% of the respondents were employed by companies with annual revenues less than 10 million Euros, while 39% worked at larger companies with more than 100 million Euro revenues. The majority of companies contracted fewer than 100 suppliers (64%) and employed fewer than 500 employees (66%). Respondents were asked to indicate their job title that reflects the position in their company. About 17% of the sample consisted of managing directors. Almost 59% held a position in sales (mostly account managers), while 24% was employed in another position. All respondents were involved in activities and decisions regarding the customer relationship management of their company, which suggests sufficient knowledge from the respondents to complete the questionnaire.

Partial Least Squares (PLS) analyses were performed using the plspm package in R (Sanchez, Trinchera, Russolillo, 2017). The variance-based PLS-SEM approach achieves relatively high statistical power even with small sample sizes and is the recommended method when working with reflective constructs (Hair et al., 2017). The analyses comprise two main steps: (1) in the first step, the 'outer' model is tested and (2) in the second step, the 'inner' model is tested. The

outer model maps the indicators on the latent factors and examines indicator loadings which analyses the measurement model and thus reliability and validity. The inner model maps the paths between the latent factors which analyses the structural or hypothesized model.

Eigenvalues did not indicate multidimensionality of any latent factor and Cronbach's alpha values are all well above the threshold values of 0.60 (Hair et al. 2014). All Average Variance Extracted (AVE) values are well above 0.40. The loadings of the indicators on the latent factors are all well above .40 and there were no cross-loadings on other factors (cf. Lowry, Gaskin 2014). In sum, results indicate unidimensionality of the latent factors and suggest that convergent and discriminant validity of each latent factor is acceptable and show evidence for the reliability of the constructs.

The results of the inner model are presented in Table 1. Five of the seven hypothesized paths are statistically significant. The results confirm the substructure of the social capital dimensions (H_1 and H_2). We also found support for the impact of relational structural social capital (H_3). However, no statistical support was found for the hypotheses that assumed a relationship between coercive power and cognitive social capital ($H4_a$) and structural social capital ($H4_b$). It appears that expert power, as expected, has a positive impact on these two social capital dimensions ($H5_a$ and $H5_b$). Figure 2 shows the structural model including the size and significance of path coefficients, as well as R^2 values.

Table 1: Size and significance of the Structural Model Path Coefficients

Path	Path Coefficients	*t Values*	Sign. Levels	*p* Values
Coercive Power -> Cognitive Social Capital	-0.084	-0.774	N.S.	0.441
Coercive Power -> Structural Social Capital	0.047	0.426	N.S.	0.671
Expert Power -> Cognitive Social Capital	0.395	3.640	***	0.000
Expert Power -> Structural Social Capital	0.419	3.810	***	0.000
Cognitive Social Capital -> Relational Social Capital	0.306	2.940	**	0.004
Structural Social Capital -> Relational Social Capital	0.216	2.070	*	0.042
Relational Social Capital -> Information Sharing	0.248	2.290	*	0.025

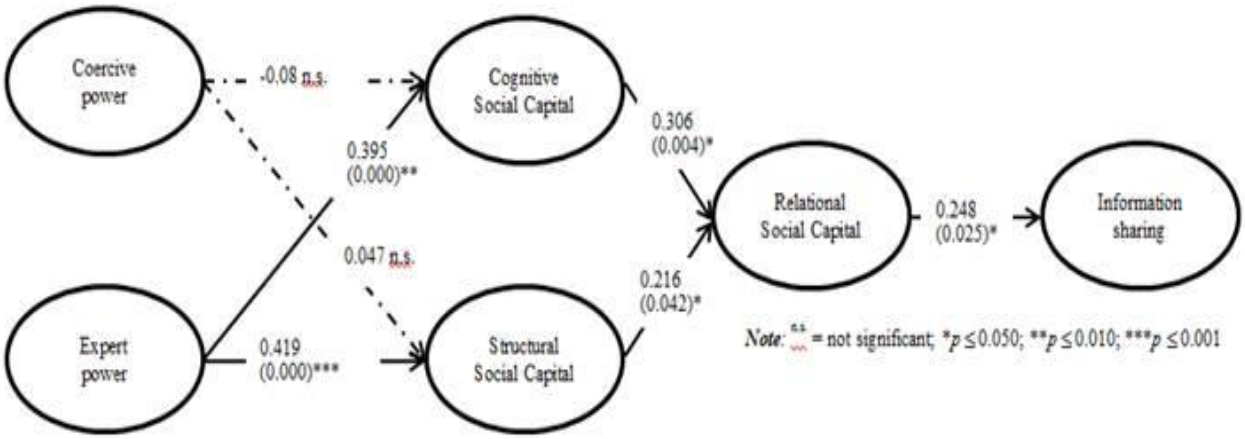

Figure 2 PLS results of the structural model

5 Conclusions and discussion

Information sharing has been extensively studied within the context of supply chain management. Literature recognizes the importance of social capital that accrues in buyer-supplier relationships. However, no studies have investigated the role of the substructure of the three social capital dimensions on information sharing. Despite the many attributed benefits, many firms seem reluctant to share important information with their supply chain partners. A high dependence asymmetry is likely to be important, although past studies seem to have overlooked the role of power in information sharing. This study was aimed at filling these gaps by investigating the interplay of power, different social capital dimensions and information sharing.

This study contributes to the body of knowledge about information sharing in buyer-supplier relationships. First, our study extends previous literature by investigating the influence of the substructure of social capital dimensions on information sharing. The results of our study confirm the theoretically based substructure of the three social capital dimensions (cf. Gelderman et al., 2016; Horn, Scheffler and Schiele, 2014; Carey, Lawson and Krause, 2011). Indeed, cognitive capital (shared meaning and understanding) and structural capital (interactions and contacts) are antecedents of relational social capital (trust, friendship, mutuality). In addition, the empirical findings support the hypothesis that links relational social capital to information sharing (cf. Li and Lin, 2006; Fawcett et al., 2007; Wang et al., 2014).

Second, although power is generally considered a key concept in understanding buyer-power relationships, dependence asymmetry appears to be an overlooked factor in information sharing studies. This study included the role of coercive and expert power for gaining additional insights in information sharing. Third, literature shows a rather inconclusive picture of the impact of power on coordination, collaborating, and information sharing in supply chains. Some studies assume a direct effect of power on information sharing (e.g. Li et al., 2014; Yigitbasioglu, 2010). In this study we have argued that power will only indirectly influence information sharing, namely through social capital. We found partial evidence for this mechanism.

Fourth, we did find a (positive) path that runs from expert power through social capital to information sharing. Suppliers appreciate the expertise of the buyer, which contributes to the a shared understanding (cognitive capital) and interactions (structural capital). However, the provision of information might not be completely mandatory. Suppliers could be forced to exchange information by the use of coercive buyer power. For this power type, we expected a negative impact on social capital which works on to information sharing. However, we did not find a statistical significant effect of coercive power on social capital. This finding is in line with the notion by some that the use of power is not always problematic and can be a positive force in supply chains, as long as the dominant party acts fairly (cf. Yigitbasioglu, 2010) and does not necessarily exploit the weaker party (cf. Pfeffer and Salancik, 1978; Caniëls and Gelderman, 2010). By distinguishing coercive and expert power, as contrasting power types, we have shed light on the complex role that power can play in information sharing between buyers and suppliers.

Also, we found a (relatively strong) negative correlation between coercive power and expert power. Apparently, these power types were employed as substitutes, not in a complementary way. In other words, a buyer that uses expert power in a supplier relation, is not likely to simultaneously use coercive power as well (and vice versa). Buyers can choose which power type to employ, depending on the supplier and the context.

6 Limitations and recommendations

This study has a number of limitations, which could induce further research. The sample was restricted to supplying companies of one buying (food producing) company. The study could be replicated in other settings, for instance by selecting less mature industries or by focusing on (innovative) startups. To get more insights into the effects of power and social capital, future research could use a dyadic approach and include the experience and views of multiple buyers and suppliers. Another limiting aspect is the cross sectional nature of this study. Experimental and longitudinal studies would be more suitable for investigating cause-effect relationships, shedding light on the interplay of the various variables under study. Case study research could be aimed at more thoroughly investigating the relationship these concepts. Another advantage of case study research is the possibility to include three or more companies from a supply chain or to include several individuals employed within different companies (cf. Kembro and Näslund, 2014).

Our research can be extended in other ways as well. Stronger parties can use influence strategies in managing their business partners (Frazier and Rody, 1991). Coercive influence strategies can produce full compliance and cooperation, although dominated parties can also show partial compliance, delayed compliance or negotiated compliance (cf. Gelderman, Semeijn and De Zoete, 2008). Future research could incorporate different types of compliance that suppliers could use in their response to requests of powerful buyers to share important information. Similarly, studies could differentiate between a willing submissiveness and a resentful submissiveness (cf. Gölgeci, Murphy and Johnston, 2017).

More and different power types could be included in research designs. Our study employed coercive power (active) and expert power (passive). The seminal typology of French and Raven

(1959) describes also reward, referent and legitimate power. Different power types can have different effects on buyer-supplier relations. The concepts of expert and coercive power in our study refer to the threat that emanates from the actual use of power. It would be interesting to investigate the effects of an actual deployment of influence strategies by powerful buyers. Future studies could also focus on the content and the quality of information shared among supply chain partners (cf. Li et al., 2014). To be more specific, research could differentiate between operational, tactical, and strategic information (cf. Wu et al., 2014). Sharing operational information on production and deliveries forms a very different context than sharing strategic information for gaining competitive value, promoting collaborative behaviors between various supply chain members.

The results of our study suggest that purchasing professionals could benefit from the finding that (the threat of using) power does not impact information sharing directly. Social relation factors do play an important intermediate role. Trust is essential for suppliers to exchange information with a more powerful customer. Buying companies should acknowledge that relational social capital (trust, respect, friendship) can be promoted by investing in cognitive social capital (shared understanding and meaning) and structural social capital (frequency of contacts and interactions) and also expert power

Buyers should think and rethink the selection and use of different power types. Expert power impacts information sharing, be it in an indirect way through high levels of social capital. The use of coercive power creates a very different situation. Although many managers might think that they can force suppliers into sharing information, our study indicated that coercive power showed no influence at all (nor positive, nor negative). Buying companies can encourage supplier information sharing by building up their own expertise and cultivating social relationships.

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Appendix Measurement of variables

Variable	Items
Coercive power [a]	The major customer's personnel would somehow get back at us if we do not make changes in our research and development.
	The major customer does not withdrawn certain needed services from us if we do not make changes in our sales. (R)
	The major customer does not hint that they would take certain actions if we do not make changes in our production process. (R)
	The major customer could have made things difficult for us if we do nog agree with their suggestions about distribution.
Expert power [a]	Our major customer ensures changes in our research and development, because we trust the customer's judgment.
	Our major customer ensures changes in our sales, because they have great business expertise about sales.
	Our major customer does not ensures changes in our production, because we usually do not have good advice from the customer. (R)
	Our major customer ensures changes in our distribution, because they have specially trained people who know what had to be done.
Information sharing [b]	We are willing to share information about the available stock with our major customer.
	We are willing to share our production planning with our major customer.
	We are not willing to share our production capacity with our major customer. (R)
	We are not willing to share our actual sales data with our major customer. (R)
Relational social capital [b]	Our major customer and we are concerned about the welfare or interests of each other when making important decisions.
	Our major customer and we are willing to offer assistance and support to each other, even if the circumstance changes.
	Our major customer and we share confidential information with each other.
	Our major customer and we do not have a close personal interaction. (R)
	Our major customer and we are willing to invest in specific resources for each other, because we maintain a close relationship.
Structural social capital [c]	Our major customer and we maintain close social relationships with each other.

	Our major customer and we do not have frequent and intensive interaction with each other. (R)
	Our major customer and we did not obtain new interactions by the cooperation. (R)
Cognitive social capital [d]	Our major customer and we share the same vision.
	Our major customer and we do not share the same ambitions. (R)
	Our major customer and we share the same goals.
	Our major customer is similar to us in that we both are willing to change for the benefit of the relationship.

(R) = recoded

[a] Brown et al. (1995), [b] Wu et al. (2014), Li et al. (2014), [c] Villena et al. (2011), [d] Li et al. (2014), Son et al. (2016)

Hard to tell: opportunistic buyer behavior in strategic supplier relationships

Cees J. Gelderman[a]

Janjaap Semeijn[b]

Mark Verhappen[c]

[a] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762590, e-mail kees.gelderman@ou.nl

[b] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762588, e-mail: janjaap.semeijn@ou.nl.

[c] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +031736150606, e-mail: m.verhappen@benier.nl

Abstract

Opportunistic behavior is a well-known reason for the failure of collaborative buyer-supplier relationships. Research on buyer opportunism typically focusses on leverage supplier relationships. Little is known about the actual opportunistic buyer behaviors in strategic partnerships. This study is the first to use the Critical Incident Technique to identify and describe actual occurrences op opportunistic buyer behavior, including antecedents and effects. Purchasing professionals have been interviewed about their own personal opportunistic behavior, resulting in rich descriptions of 29 critical incidents. Most commonly, multiple expressions of opportunism are used in the same incident, grouped into not honoring agreements (1), lying and cheating (2), and abusing power positions (3). Several buyers put the responsibility of opportunistic behaviors on their superiors or on the pressure for short term results. Sometimes opportunism was a reaction to perceived supplier opportunism. Buyers applied opportunism when the relation with their supplier was already deteriorating.

Keywords: buyer opportunism, strategic supplier partnerships, critical incident technique

Category: competitive paper (IPSERA 2018)

1 Introduction

Collaborative relationships with strategic suppliers are generally considered crucial for company performance and market competitiveness (e.g. Yen & Hung, 2017). Organizations increasingly outsource strategically important functions and activities, which makes supplier collaboration vital for the success and performance of companies (e.g. Raassens et al., 2012). However, governing such relationships can be problematic, resulting in failure. Opportunistic behavior by either party is considered an important reason why many collaborative relationships enter into difficulties or even fail (e.g. Bhattacharya et al., 2015; Raassens et al. 2012). Opportunism implies a choice for self-interest with malicious intentions and at the expense of the partner. Consequences can be very serious, like conflict (Barnes et al., 2010), reduction of trust, (Mysen et al., 2011), destabilisation (Anderson & Jap, 2012), reduced willingness to invest (Suh & Houston, 2010) or relationship termination (Kang et al., 2016).

Studies report contradictory findings regarding the antecedents of opportunistic behavior. Williamson (1975) states that knowledge-sharing stimulates opportunism, although Yam & Chan (2015) found the opposite. It is generally agreed that trust reduces opportunism (e.g. Liu et al., 2009), while but excessive trust (Carey, Lawson et al., 2011) as well as little trust (Vidal, 2014; Kang et al., 2016) appear to be positively related to opportunism. A long term focus is likely to reduce opportunism (Choi et al., 2015; El Rahman, 2015), although Hawkins, Wittmann et al (2008) found that the contract span stimulates opportunism. Contrasting results were also found for dependency and buyer opportunism. Crosno et al. (2008) reported a negative relation, while Joshi & Arnold (1997) found a positive impact of dependency. These contradictions call for a deeper investigation into the actual causes and motivations of opportunistic behavior.

Most commonly, research on opportunism involves studies on supplier opportunism (e.g Villena et al, 2011). The extant literature has focused on opportunistic behavior of suppliers, investigating the safeguards buyers need to put in place to protect their interests (e.g. Bhattacharya et al., 2015). Buyer opportunism is assessed by suppliers or sales representatives (e.g. Choi et al., 2015). These studies however, yield few insights into actual opportunistic behavior by purchasers, their underlining motives and effects on buyer-supplier relationships.

The few academic studies on buyer opportunism are mostly in the form of survey studies (e.g. Villena and Craighead, 2016; Bhattacharya et al., 2015; Hawkins et al., 2013; Liu et al., 2010). These studies are aimed at testing hypotheses concerning specific antecedents and consequences of opportunistic buying behavior. However, these studies provide little knowledge about the actual use of opportunistic buying behavior and the conditions that induce or stimulate the use of such negative tactics. More research is needed on the antecedents and effects of actual opportunistic buyer behavior. In contrast, our study is aimed at contributing to our understanding of buyer-supplier relationships by exploring the reasons and motives for actual buyer opportunism

Research on buyer opportunism is typically focused on leverage supplier relationships, not on strategic partnerships (e.g. Hawkins et al., 2013; Joshi & Arnold, 1997; John, 1984; Vidal, 2014; Bhattacharya et al., 2015). Despite the negative effects of opportunism, buyers still

behave opportunistically even in strategic supplier relationships (Liu et al., 2010). It remains unclear why buyers persist in the use of opportunistic tactics. This study investigates actual buyer opportunism within strategic supplier relationships, as viewed by buyers who actually engaged in such behavior. The leading research question is: what is the role of buyer opportunistic behavior in strategic supplier relations?

Our study focuses on self-observed buyer opportunism and aims to gain a deeper understanding of true motives, manifestations, and consequences of buyer opportunism. The Critical Incident Technique (CIT) was used to identify and describe actual occurrences of opportunistic behavior, antecedents and effects. Purchasing professional in the Dutch manufacturing industry were interviewed, resulting in rich descriptions of 29 critical incidents of opportunistic buyer behavior.

2 Theoretical background

2.1 Strategic supplier relationships

As companies do not have all the resources needed for competitiveness, they will seek to build relationships with supplying firms. Developing strategic relationships with innovative suppliers is a viable, well-known innovation strategy (e.g. Oke et al., 2013). Buyers aim to leverage strategic supplier relationships to gain competitive advantage. Such buyer-supplier relationships may develop into a strategic supplier partnership requiring compatible goals, coordination, planning, and problem solving efforts (e.g. Qrunfleh & Tarafdar, 2013). Strategic supplier partnerships are long-term relationships that influence the strategic and operational capabilities of individual participating companies to help them achieve significant ongoing benefits (Li et al., 2006). These relationships require direct association, mutual planning and problem solving, continuous improvement, and selection of a limited number of suppliers (e.g. Gunasekaran et al., 2001). Such partnerships enable information sharing, joint improvement activities, and integration, leading to greater responsiveness (cf. Qrunfleh & Tarafdar, 2013). Strategic, integrated relationships are characterized by high levels of commitment, conflict resolution, cooperation, and trust (cf. Maloni & Benton, 2000).

Literature suggest many differences among partnerships (e.g. Kim & Choi, 2015). In the ideal case, strategic partnerships are based on equality in which both parties have an interest in a flourishing long term relationship (e.g. Caniëls & Gelderman, 2007). These relationships are characterized by interdependencies, trust, commitment, and an open exchange of information. A very different type of relationship is a ‘locked -in partnership’, in which a company has no alternative than to maintain the currently employed relationship (Harrison et al., 2012). A locked-in relationship is most commonly due to unchosen, unfavourable conditions. The partner at a disadvantage can be trapped in the relationship and can be exposed to opportunism (Grandinetti, 2017). A buyer might be forced by patents, a monopoly position of the supplier, high switching costs or by the demands of a major customer (Gelderman & Van Weele, 2003). The buyer then could try to make the best of the situation by starting a long term relation, not entirely voluntarily and therefore probable less intense than in a real partnership. Successful alliances bring great rewards, such as higher stock exchange value, improved competitiveness and reputation (Dyer et al., 2001). When relationships fail to

achieve continuity of supply and cost reduction, partners typically face a substantial fall back in performance (Kang et al., 2016).

2.2 Buyer opportunism

Academic publications on opportunism generally use Williamson's (1975, p. 6) definition: "self-seeking interest with guile" (p. 6) "at the expense of the partner" (Kang et al., 2016 p. 240). Opportunism is often conceptualized in behavioral terms such as 'deceitful withholding of information' and 'failing to keep promises' (e.g. John, 1984). These behaviors should not be confused with normal business practice based on implicitly shared (relational) norms, such as hard bargaining, demonstrating competitive behavior, entering into necessary confrontations and constructive conflicts (Young and Wilkinson, 1997).

Hawkins et al. (2008) divide opportunism-related research in two streams. First is the Transaction Cost Analysis (TCA) approach focusing on institutional and legal aspects and rational human behavior. For instance *bounded rationality* assumes that human cognitive abilities are limited so that they will not always act rationally (and sometimes opportunistically). People will exhibit opportunistic behavior when they think this is beneficial. In contrast, the Social Exchange Theory (SET) rejects opportunism, emphasizing relational aspects of a relationship such as trust, commitment, cooperation, satisfaction, and relational standards. Hawkins et al. (2008) consider opportunism in partnerships an aggressive pursuit of self-interest without regard for others which manifests itself in forms such as theft, fraud, breach of contract, dishonesty, data manipulation, false promises, threats and withholding information. Such behaviors are morally reprehensible and legally questionable.

The extant literature discusses various types of opportunism, see Table 1. Wathne & Heide (2000) distinguish between 'blatant' and 'lawful 'opportunism. Blatant opportunism is inconsistent with contractual and other explicit agreements, for instance lying (Yam & Chan, 2015), theft, deception, guile (Williamson, 1989), threats, dishonesty, and data manipulation (Hawkins et al., 2008). Blatant opportunism is often illegal. In contrast, 'lawful' opportunism concerns behavior which is not inconsistent with agreements, but rather with common decency or other social aspects of relationships. Examples are withholding information (Williamson, 1989), using loopholes in contracts (Yam & Chan, 2015; John, 1984), indecent behavior, avoiding agreements and coming back on agreements (Wathne & Heide, 2000).

Opportunistic behavior can be further typified as 'active' or 'passive' (Wathne & Heide, 2000). Active opportunism involves expressively forbidden behaviors (Das & Kumar, 2012). Active opportunism is directly related to financial loss and involves an explicit action (Kang et al., 2016), for instance supplying low-quality products for the purpose of making higher profit margins Mpinganjira et al., 2015). Examples of passive opportunism are avoiding contact (Yam & Chan, 2015), refusal to adapt (Wathne & Heide, 2000) and withholding information (Williamson, 1989). Similarly, Hawkins et al. (2013) distinguish between 'strong' and 'weak' opportunism. In case of weak opportunism there appears no identifiable perpetrator at the time of execution, as opposed to the 'strong' variant. Weaver & Dickson (1998) divide opportunism in the categories 'objective' and 'perceived'. Objective

opportunism refers to behavior that can be expected on the basis of contracts, while perceived opportunism is about breach of social relationships.

Opportunistic behavior	Type of opportunism	Source
Withholding information	Lawful/Passive	Williamson (1989), Hawkins et al. (2008)
Withholding know-how	Passive	Kang, Han et al. (2016)
Threats	Blatant/Active/Strong/Perceived	Hawkins et al. (2008)
Deceit	Blatant/Active/Strong/Objective	Williamson (1989), Hawkins et al. (2008)
Breach	Blatant/Active/Objective	Hawkins et al. (2008)
Data manipulation	Blatant/Active/Strong/Objective	Hawkins et al. (2008)
Theft	Blatant/Active/Strong/Objective	Williamson (1989), Hawkins, Wittmann et al. (2008)
Lying	Blatant/Active/Strong	Yam & Chan (2015), Kang et al. (2016)
Use of loopholes in contract	Lawful/Perceived	Yam & Chan (2015), John (1984)
Misleading	Blatant/Active	Williamson (1989)
Dishonesty	Blatant/Perceived	Hawkins et al. (2008)
Indecent behavior	Lawful/Strong/Perceived	Wathne & Heide (2000)
Avoiding contact	Lawful/Passive	Wathne & Heide (2000)
Come back on agreements	Lawful/Active	Wathne & Heide (2000)
False promises	Blatant/Active/Strong	Hawkins et al. (2008)
Refusal to adapt	Passive	Wathne & Heide (2000)

Table 1: Types of opportunistic behavior

2.3 Consequences of opportunism within a partnership

The consequences of opportunism within a partnership can be severe. Serious cases can lead to a conflict (Barnes et al, 2010; Joshi & Arnold, 1997), and destabilization of the relationship (Anderson et al., 2012). ‘Active’ opportunism can even result in the termination of the cooperation and thus loss of "sunk costs" or depreciation of investments in the relationship (Kang et al., 2016). An opportunism-threat may even result into an increased risk of acquisition by the customer (so a customer buys a supplier) (Hawkins et al., 2008).

A major concern of opportunism is the negative effect on performance in a buyer-supplier relationship (e.g. Joshi & Arnold, 1997). Opportunism will reduce flexibility (Samaha et al., 2011), and the willingness to invest (Suh and Houston, 2010). A related issue is the undermining of trust (e.g. Barnes et al, 2010; Hawkins et al, 2008; Joshi & Arnold, 1997; Mysen et al., 2011), the reduction of commitment (Joshi & Arnold, 1997; Mysen et al., 2011; Suh and Houston, 2010), and the reduction of satisfaction (Seggie et al., 2013; Joshi & Arnold, 1997). In general, opportunism is likely to result in lower levels of social capital (Carey et al., 2011), incoherence and uncertainty (Wang et al., 2010).

Finally, opportunistic behavior may evoke opportunistic responses from the other party (e.g. Yen & Hung, 2017; Caniëls & Gelderman, 2010). A victim of opportunistic behavior could react by shirking (Handley & Benton, 2012; El Rahman, 2015) or evasion of obligations or

deliberately underperforming. A victim could also react by ‘poaching’, which can be described as deploying common resources or knowledge purely in self-interest, without the knowledge of the partner(Handley et al., 2012). Another reaction might be free riding (El Rahman, 2005), parasitizing on the relationship, and manifestations of retaliation (Vidal, 2014). Opportunism undermines the strategic partnerships by reducing output and trust.

2.4 Antecedents of opportunism

One of the aims of this study is to understand the causes of buyer opportunism in strategic supplier relationships. We will investigate opportunistic buyer behavior from three different theoretical perspectives: Transaction Cost Economics (TCE), Social Exchange Theory (SET) and Resource Dependence Theory (RDT), as depicted in Figure 1.

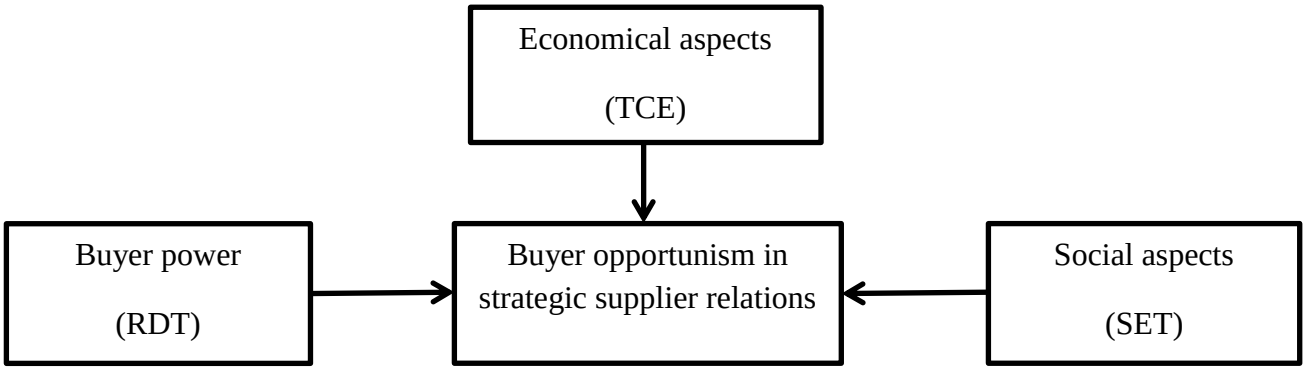

Figure 1 Theoretical antecedents of opportunism

2.4.1 Transaction Cost Economics (TCE)

TCE attempts to understand complex economic organizations by combining legal, economic and organizational theories (Williamson, 1989) and forms the basis of a large group of possible antecedents of buyer opportunism. Important in this context are the relation-specific investments (e.g. Kang et al., 2016; Choi et al., 2015). As these investments are greater, the risk of ‘sunk cost’ will increase when ending the relationship and partner opportunism will therefore be less likely.

The next important subgroup is the planning horizon of the partners. Pressure on short-term results can trigger partners into inappropriate behavior (Kang et al., 2016), while a long-term orientation of buyers suppresses this behavior (e.g. Choi et al, 2015. El Rahman, 2015). Hawkins et al. (2008) argue that there is a positive correlation between the length of a contract and opportunism. A mismatch of objectives (Hawkins et al., 2008), and inequality of profit distribution (Kang et al., 2016) are potential antecedents of opportunism.

Other antecedents relate to human limitations in the decision-making process that can lead to wrong decisions. El Rahman (2015) cites excessive self-confidence, blind spots and uneven valuation of profits and losses. John (1984) adds that the possibility of personal gain (rewards) induce blurring of standards of individuals. Finally there is economic ethnocentrism (Lee,

1998) that makes people to some extent feel that their "own" group is superior, which may lead to negative behavior towards the partner.

As the anticipated risks relating to the relationship and the shared objectives grow, the chance of ‘active’ forms of opportunism will increase (Kang et al., 2016). There are various forms of uncertainty that contribute to opportunism. Lee (1998) specifically mentions decision making uncertainty, Wang et al. (2013) adds uncertainty in behavior of the partner and Crosno et al. (2008) finally environment uncertainty, i.e. unexpected changes in circumstances. Mysen et al. (2011) points at market turbulence. Finally role conflicts and ambiguity lead to risk, which in turn leads to opportunism (Kang et al., 2016).

2.4.2 Social Exchange Theory (SET)

SET is a social psychological and sociological perspective in which human relationships are central to a business cooperation. Being based on human interactions it is clear that many antecedents of opportunism come can from this perspective. The first subgroup consist of relational norms and values. "Relational norms are expectations with regard to behavior which at least are supported by part of a group of decision-makers, which have proven to contribute to individual interactions between businesses" (Hawkins et al., 2008 p. 903). These relational norms are said to be negatively related to opportunism (e.g. Tang Pong et al., 2010; Joshi & Arnold, 1997; Caniëls & Gelderman, 2010). Hawkins et al. (2013) recognize the negative relation between opportunism and ‘corporate ethical values’ (CEV), honesty and integrity, and the positive relation between avoiding responsibilities and ‘subjective expected utility’, meaning that people tend to pick the option that seems to deliver maximum results. Furthermore, Hawkins et al. (2012) and Hawkins et al. (2013) demonstrate that subordinates follow the behavior displayed by their superiors.

Various studies have shown that differences in the culture of partners can lead to opportunism (e.g. Lee, 1998; Kang et al., 2016). Not unexpectedly, Kang et al. (2016) found that rivalry between two parties and communication problems can induce opportunism. Relationships benefit from a higher frequency of transaction (Bhattacharya et al, 2015) and contact (Hawkins et al., 2008; Wang et al., 2013). The amount of the social capital, or the value of social relationships, has a negative relationship with opportunism (Villena et al., 2011).

A major issue of opportunism within SET relates to trust. Trust is the confidence of one partner in the honesty and goodwill of the other partner (Liu et al., 2009). Generally, trust reduces opportunism (Liu et al., 2009; Hawkins et al., 2008). This effect is enforced when trust is linked to formal contracts (Liu et al., 2009). Apparently there is such a thing as an optimal level because a lack of trust stimulates opportunism (Vidal, 2014. Kang et al., 2016) as well as over-confidence (Carey et al., 2011; Granovetter, 1985). Wang et al. (2013) call ‘identification based trust’ a form of blind faith inducing opportunism. Still, literature reflects controversy about the effectiveness of contracts in mitigating opportunism (e.g. Yang et al., 2017).

2.4.3 Resource Dependency Theory (RDT)

An important tenet of the Resource Dependency Theory is that is considers the ability to acquire and maintain resources as the key to organizational survival. Every organization must transact with elements in the environment to acquire the many resources that it depends on (Pfeffer & Salancik, 1978). The dependence on resources creates power relations and problems of vulnerability for the weaker party to opportunistic behaviors (e.g. Schmitz et al., 2016). Powerful companies may behave opportunistically by exploiting the available opportunities. Due to their power within the network, there will be little to no repercussions of such opportunistic behavior (Morgan et al., 2015).

RDT examines how external sources influence the behavior of an organization. John (1984) states that a dominant power position of the supplier ('coercive power') is positively related to buyer opportunism. However, Caniëls & Gelderman (2010) conclude that a dominant power position of the vendor can have a moderating effect on buyer opportunism, provided that the power is not being used. Furthermore, it is clear that RDT related opportunism plays a particularly important role in 'locked-in partnerships' so that there is an imbalance in the balance of power. Hawkins et al. (2013) show that buyer power enforces 'strong form' opportunism, but not the 'weak form'. In line with RDT, we expect that buyers will try to decrease their dependence on suppliers and to increase the suppliers' dependence (e.g. Oke et al., 2013). Buyers might rely opportunistic behaviors in order to manage, to reduce, and to avoid dependence on suppliers (e.g. Pfeffer & Salancik, 1978).

Joshi & Arnold (1997) note that dependence is positively related to opportunism under 'low relational norms' but negative under 'high relational norms'. In general, dependence has been shown to have a negative relationship with buyer opportunism (e.g. El Rahman (2015; Crosno et al., 2008). A power-dependence relationship develops when a company becomes dependent upon another organization and has a relatively low degree of autonomy. A company might suffer from opportunistic behavior when autonomy is low due to the asymmetric dependence on a business relationship (e.g. Lee et al., 2015). However, it should be noted that RDT places dependence problems in perspective. Dependence as such is not problematic, problems arise when dealing with less dependable partners (Pfeffer and Salancik (1978).

3 Methodology

The critical incident technique (CIT) is used to investigate significant occurrences (events, incidents, processes, or issues) identified by respondents, the way they are managed and the perceived effects. A key advantage of CIT is that it asks for unprompted information, deemed to be important for respondents (e.g. Oldenburger et al., 2008). The technique is believed to be effective in explorative studies, aimed at gaining understanding of the perceived impact of incidents and ultimately at solving practical problems (Flanagan, 1954). CIT has been used in a wide range of disciplines (Gremler, 2004), notably in service encounters (e.g. Bitner et al., 1990). However, CIT is not a commonly used method in research on purchasing and supply management (Gelderman et al., 2016).

A critical incident in our study is considered any form of buyer's opportunistic behavior within a strategic supplier relationship. Prior to the interviews, each respondent was informed in writing on the purpose of the study and what was meant by certain key terms (cf. Hamlin et al., 2011). Trust, a guarantee of confidentiality, anonymity and a relaxed atmosphere are prerequisites to allow respondents to speak sincerely about their 'inappropriate' behavior.

In general, the validity of the research will increase with the number of observations, wherein saturation is the goal. Upfront it is hard to predict how many critical incidents and respondents are sufficient to achieve adequate validity. Respondents were selected from a professional purchasing network in the Dutch manufacturing industry, based on their first-hand experience with opportunistic behavior in a strategic supplier relationship. It is important that respondents have sufficient experience and authority within purchasing in order to provide valuable information, where a possible threat of respondent bias should be kept in mind. Each respondent was asked to describe their own opportunistic behavior in the course of a strategic buyer-supplier relationship.

Each interview was fully transcribed and then coded. Variables are recoded when necessary to have a positive relationship with opportunism. For example, 'relational norms' was renamed 'lack of relational norms' to indicate a positive relationship with opportunism. For the five antecedents of opportunism with contradictory academic findings both a positive and/or a negative relation to opportunism was registered. In the interviews special attention was given to the role of antecedents. Respondents were asked for each critical incident to elaborate on issues of power, opportunism-display and types of partnership. Respondents were encouraged to provide factual reports, rather than interpretations (cf. Hughes et al., 2007).

4 Results

4.1 Respondents and critical incidents

During a period of ten weeks in 2016, twelve respondents were interviewed, generating a total of 29 critical incidents. Table 2 provides an overview of the job titles and the years in which the critical incidents took place. In small companies, the roll of strategic buying with partner suppliers is often performed by the director or owner. That was the case with respondents numbers six, seven and eight. A maximum of three critical incidents per respondent was set. This has yielded a total of 584 minutes of recording, resulting in over 200 pages of transcripts. After 12 interviews is was decided to conclude the data collection process, since saturation appeared achieved.

It is striking that the majority of cases showed multiple expressions of opportunism within the same incident. These various expressions were grouped into not honoring agreements (1), lying and cheating (2), and abusing power positions (3). In almost all incidents, the buyer abuses its dominant position, mostly in combination with one or both of the other categories. Some of the literature-based opportunistic behaviors were not reported. Respondents might prefer to describe themselves in milder terms. 'Lying' and 'cheating' sounds worse than 'misleading' and 'coming back on earlier agreements'.

Resp.	Job titles of respondents	Incident 1	Incident 2	Incident 3	date
# 1	Buyer machine factory	2008	2008	2014	10/6/2016
# 2	Buyer metal machining company	2005	x	x	15/6/2016
# 3	Purchase-manager machine factory	2014	2016	x	15/6/2016
# 4	Free-lance project buyer	2003	2007	x	22/6/2016
# 5	Buyer packaging industry	2012	2015	x	7/7/2016
# 6	Owner/MD metal construction company	2015	2016	x	21/7/2016
# 7	Owner/MD plastic moulding company	2013	2010	2005	22/7/2016
# 8	Buyer machine factory	2012	2012	2013	28/7/2016
# 9	Buyer machine factory	2016	2016	2016	5/8/2016
# 10	Purchase manager chemical industry	2011	2015	2015	9/8/2016
# 11	Purchase mgr conveyor belt manufacturer	2015	2016	x	11/8/2016
# 12	Buyer machine factory	2008	2008	2005	25/8/2016

(x): Respondent could not report on other incidents

Table 2: Job titles and years of critical incidents

4.2 Displays of buyer opportunism

It should be noted that buyer opportunism with partner suppliers does not to occur very often in Dutch industry. Several approached potential respondents could not find any occurrence of this behavior, even after the 'prompting' examples of others. More than half of the respondents who had experience with opportunism could remember fewer than three incidents even though they had been buyers for 15 years or longer.

A pattern emerged of behavior that is generally associated with leverage suppliers, such as setting competitors against each other and hard bargaining on price, i.e. a combination of exploiting buying power and focus on short-term gains. In some incidents it was even explicitly stated that the action was intended to get rid of the partner. Examples include expressions such as "*we wanted them out of the strategic box*" (incident 10.1), and "*we realized that we had become dependent and therefore we have taken action*"(incident 12.3).

4.3 Consequences of buyer opportunism

A large variety of effects of buyer opportunism was found. We found that no relationship appears able to withstand blatant opportunism. If opportunistic behavior against suppliers has become the standard, there seems to be no basis left for strategic cooperation. In a minority of cases, the buyer thought that the opportunistic act had no apparent impact on the relationship, but it is questionable whether the purchaser is always able to form a complete judgement. The hidden damage can be much greater than the buyer can estimate. However, it means that in the vast majority of cases the buyer is aware of the resulting negative consequences for the relationship. In some incidents, the relationship was even terminated, but more often it was downgraded to less cooperation and lower levels of relationship intensity. Several buyers specifically intended to downgrade a strategic partnership to a leverage relationship.

4.4 Antecedents of buyer opportunism

Hereafter, the antecedents of buyer opportunism are examined and explained by using the three theoretical perspectives.

4.4.1 Transaction Cost Economics (TCE)

Every critical incident showed at least one TCE antecedent, making it the most common category. Especially from this perspective buyers appear to get encouraged to use 'leverage' tactics. Not surprisingly "pressure on short-term results" was the most frequently mentioned argument. Buyers apparently have trouble with things they cannot predict or control. For example, the buyer of incident 6.1 blurted; "*I will make sure he can't control me* ".

Before the respondents perform opportunism it appears that they often first make an assessment of the risks of their behavior, confirmed by statements like "*even with no deal I would still be the winner*" (incident 7.3) and "*I'm confident that they won't find out. Otherwise I wouldn't have done it"* (incident 5.2).

The buyer's short-term orientation combined with leverage tactics appeared several times in the study. In this case suppliers had a long-term orientation, (incident 6.2): "*The partner wanted to be a partner, but we just wanted the best deal*." On the other hand, opportunistic suppliers sometimes intend to harvest on the short term (incident 9.3): *"We saw him as a partner, but he felt he didn't make enough money."* Sometimes the supplier has no plans at all because the customer no longer fits into the strategy. "*We may have the idea that we have a good partner, and we might not fit into their sales strategy, and they only do business because we asked and we should stop whining"* (incident 3.2).

Buyer's personal issues can easily escalate into a conflict in which the relationship incurs serious damage or is even terminated. These issues appear not very important, like a representative that is seen as too inexperienced (incident 9.3). In addition, statements are made as "*personal satisfaction*" (incident 5.1 and 5.2) and "*eye for an eye, tooth for a tooth*" (incident 9.1). Emotionally touched buyers want to deliberately inflict damage to the relationship and thereby appear to lose sight of the higher importance of strategic cooperation, as the statement "*I did it for my own satisfaction*" illustrates (incident 5.1)

A disadvantage of bonus structures is that they are often based on short-term results and they can therefore potentially stimulate opportunism. In this study, however, personal gain was only mentioned once as antecedent of opportunism and then even as a minor factor. Personal gain therefore appears not to play a significant role in buyer opportunism.

4.4.2 Social Exchange Theory (SET)

In all incidents one or more SET antecedents appear to promote opportunism. Apparently, the relationship was not ideal prior to the incident. "Dissatisfaction with the relationship" and "little trust" were mentioned most often. When the relationship seemed fine, buyer opportunism was caused by explicit orders from higher management or by a sudden deterioration of the supplier's performance. A respondent (incident 1.2) was irritated by the

many ‘back door’ visits of representatives and technicians. The vendor obtained too much knowledge and information, contributing to the buyer’s decision to become opportunistic.

Trust plays a role in half of the incidents. Although prior studies show that trust has a reducing effect, this was not observed in any of the incidents. The incidents in our study showed that both too little and too much trust can be antecedents of opportunism. When "much trust" is being embarrassed in most cases it leads to an emotional response from the buyer, leading to anger and revenge. The relationship is then beyond rescue, it gets damaged and is often terminated. Also, tust may have a ground-breaking effect. One buyer thought he would get away with opportunism because, there was a solid basis of trust (incident 12.1). Little trust in often leads to an emotional response from the purchaser repeatedly falling into retaliation. The buyer in all cases steers towards ending the collaboration.

It is striking that knowledge is seen as valuable by both parties and that both want to get the upper hand. Knowledge at the partner can apparently be seen as a threat. In this way, knowledge equals power which is sought by the buyer. In incident 10.2 it was stated that "*it is a supplier, so a third party and we should not tell everything"*.

4.4.3 Resource Dependency Theory (RDT)

In terms of power-balance almost all relations in this study were based on equivalence, or with a slight advantage to the purchasing party. Not surprisingly, therefore, only five cases of "locked-in" partnerships were registered. Most of our sample is based on equality. In cases where one of the parties is slightly more powerful only half of the cases showed RDT-type antecedents. In locked-in relationships however RDT antecedents were found significantly more often than in balanced relationships. Apparently a higher degree of dependence stimulates buyers opportunistic behavior. Dependency appears positively related to opportunism. Low dependence encouraged buyers to act with opportunism. This conclusion is confirmed by statements like *"I will get away with it because I am powerful*” (incident 8.1), "*I will easily find another supplier"* (incident .2) and "*because they wanted us real bad, I took as much as I could”* (incident 12.2).

In situations where the buyer was dependent, we found evidence for both a stimulating and an inhibiting effect on buyer opportunism. In the situation of incident 9.1 the buyer is dependent because he is bound to a particular supplier by head office contracts. The combination of centralization, formalization and dependence created a certain arrogance at the supplier and a personal aversion by the buyer. The buyer then becomes engaged in a personal vendetta, and therefore it is a case of ‘low relational norms’. In addition, we found instances where the buyer was aware of his dependence and took a rational decision not to be opportunistic. "*I need the source code, otherwise I would have played harder*” and "*I remained on speaking terms because a lawsuit was not a solution*" (incident 7.1) are clear examples of the inhibitory effect of high relational standards on buyer opportunism. When buyers were aware of their dependence they may take measures to reduce it. "*We wanted to get out of the strategic box*" (incident 10.1) and "*We realized that we were dependent and therefore we have taken preventive countermeasures*” (incident 12.3) are examples.

In general, many buyers seem to have trouble with the dependence associated with strategic supplier relationships and use their power to escape from it, not only when the balance of power is to their disadvantage.

5 Discussion

Some surprising discoveries were made in this study. It appears that 'personal gain' (or 'reward') hardly plays any role, which contradicts the conclusions by John (1984). This study also could not confirm the conclusions of Hawkins et al. (2013) that a dominant buyer power position promotes the use of 'weak form' opportunism.

A basic prerequisite for a strategic supplier relationship is a long-term orientation (Monczka et al., 1998). When indeed there was a mismatched alliance horizon, the relationship was beyond rescue, all in line with the findings of Choi et al (2015) and El Rahman (2016). It is striking that in all cases where this antecedent occurred, opportunism category "buyer abused dominant power position" was practiced. Thus, in case of mismatch of alliance horizon, the buyer easy falls back to abuse of power.

The extant literature posits that dependence may give rise to power and that power breeds opportunism (e.g. John, 1984). The results of the study provide support for this relationship, since dependency appears positively related to opportunism. This finding can be partly explained by the relational norms (Joshi & Arnold,1997), as shown by this study, but it seems that dependence (c.f. Mysen et al., 2011) also plays a role. Our study makes clear that 'satisfaction with the relationship' is negatively related with opportunism (cf. Villena et al., 2011; Wang et al., 2013), and suggests that buyers only fall into opportunism when they are not satisfied with the relationship or when they are forced by internal stakeholders cf. (Hawkins et al, 2008; Wang et al, 2013). In our study this was found several times.

In our study we did not find evidence to support Hawkins's et al. (2013) conclusion that a dominant power situation stimulates 'strong form'- but not 'weak form' buyer opportunism. 'Weak form' opportunism was only found a few times, in situations where the buyer was the powerful party. We found that a dominant power position of the supplier is positively related to buyer opportunism, which is in accordance with John (1984) and Caniëls et al. (2010), since suppliers actually abused their dominant power position in all critical incidents.

6 Conclusions and recommendations

In general the reason for using opportunism is to obtain short-term gains in spite of the possible long-term adverse effects. From the literature 16 possible opportunistic tactics were defined (Table 1). In our empirical study, 11 of these were actually observed and two new ones were added, namely 'abuse of power by exercising pressure' and 'leverage tactics with partner'. Tactics can be categorized into three groups: the buyer does not stick to agreements (1), the buyer lies and cheats (2), and the buyer abuses a dominant power position (3).

Our study indicates that buyer opportunism within strategic supplier relationships always consists of abuse of power, usually in combination with lying/cheating and/or do not honor agreements. Several buyers intended to downgrade a strategic partnership to a leverage

relationship. Usually opportunism concerns an individual action of a single buyer (= deviant personal opportunism), although in many cases it appears to be driven by top management, or is it an integral part of the company culture (= blatant opportunism). Buyers regularly act on explicit instructions from their superiors, or they feel compelled by pressure for short-term results or unworkable procedures and protocols.

Some clear patterns become visible. Buyers often only accept limited responsibility for their own behavior. Instructions from above, unworkable protocols, and corporate culture and pressure for short term results are frequently mentioned as motives for opportunistic behavior. Also, opportunism often appears a conscious choice of a buyer, based on a sound assessment of risks and consequences of opportunism. Lastly, buyers tend to lapse into power games which are more appropriate for dealing with leverage suppliers.

In the vast majority of incidents, opportunism had harmful effects on the relationship, such as insecurity, conflict, destabilization and undermining of trust. Sometimes, the relationship ended but more often it got damaged to an extent that it could no longer be called a strategic partnership. Our findings indicate that buyers only decide to act opportunistically if they felt already dissatisfied with the relationship. It is therefore unlikely that the relationship would have remained optimal even if the buyer had not taken to opportunism.

If companies have decided that strategic partnerships with suppliers are necessary and appropriate, it is also necessary to take measures to prevent, recognize and fight opportunism. The study shows that governance structures often encourage buyer opportunism although they intend to achieve the opposite. Often buyers feel that their opportunistic behavior is induced by company rules, supervisor instructions, corporate culture and pressure for short term results. Purchasing professionals could benefit from clear guidelines and accepted behavioral norms for dealing with strategic suppliers.

The study has several limitations. We felt that saturation was achieved after 29 relevant ‘critical incidents’, since no new manifestations of buyer opportunism were observed. Anonymity was promised in advance and assured. Still, the results of this study should be interpreted with caution, since the findings are based on self-reported, socially less-accepted behavior. It seems that people do not easily admit to lying or to behaving dishonestly, but rather call it “misleading” or "coming back on previous agreements”. Furthermore, a number of antecedents such as ‘blind spots’, ‘excessive self-confidence’ and ‘ethnocentrism’ are difficult to recognize by respondents. A promising avenue for future study could be a focus on the potential role of subjective perceptions, interpretations and meaning-making of the involved professionals. Future research might want to explore the justifications of purchasing professional for their unethical and opportunistic behaviors.

More in general, organizational buying behavior is most commonly considered a rational, cognitive and object process, driven by logic and not emotions. However, we agree with Kemp et al. (2018) that emotions do play an important, be it understudied, role in organizational buying. Future studies could investigate the influence of emotions on the deployment and effectiveness of opportunistic buying behavior.

Obviously there are also factors that have an inhibitory effect on buyer opportunism. Further research is needed to increase understanding and theoretical anchoring. This study was limited to Dutch industrial buyers who reported not much opportunism. We might assume that that different standards prevail in other sectors and other countries. Future research could try to shed more light on sectorial and cultural differences regarding antecedents and effects of buyer opportunism. Since we build our findings on expert interview, our results may serve as a basis for further quantitative research.

There are recommendations for practitioners too. Buyers tend to get negatively emotionally involved when it comes to trust issues, leading to a desire for revenge. Negative emotional involvement almost always encourages the buyer to break up the relationship. It is highly questionable whether a personal incident is a valid reason for a company to break a valuable partnership. If companies aim for long-term partnerships with suppliers they must ensure that buyers build a relationship on a business foundation. When the emotional bond evolves into something counterproductive, companies should assign that supplier to other buyers.

Buyers dealing with strategic suppliers (partners) require different profiles and characteristics than those dealing with leverage suppliers or suppliers of non-critical items . A partner-buyer must have sufficient emotional stability skills and act as a relationship intermediary. He should have a long term orientation, excellent communication skills and be well integrated within his own company. A leverage buyer, on the other hand, is more of a street fighter who focusses on short-term gains and frequent changes of suppliers. Opportunism is intended and required here. Is it realistic to think that one individual can excel simultaneously in both situations? Segregation of duties for strategic and tactical purchasing in this case, will improve the quality of purchasing. Because buyers often have few partner suppliers lack of experience can also play a role. Proper education and training would be a major contribution.

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The evolution of Supply Chain Finance: an exploratory study of Dynamic Discounting

Luca M. Gelsomino[1*], Antonella Moretto[2], Federico Caniato[2] and Michiel Steeman[1]

1 Strategic Entrepreneurship Research Centre, Windesheim University of Applied Sciences, Campus 2-6, 8017 CA, Zwolle, The Netherlands

2 Department of Management, Economics and Industrial Engineering, Politecnico di Milano, via Lambruschini 4/b, Milano, Italy

(*) corresponding author: lm.gelsomino@windeshiem.nl

Abstract

In response to an increased uncertainty and financial instability of modern supply chains, companies have been leaning towards Supply Chain Finance schemes. Among these schemes, Dynamic Discounting (DD) is growing in importance. Literature on DD is exceedingly scarce and devoid of empirical evidence. The purpose of this study is to analyse the different archetypes of DD and which drivers affect buyers in choosing among them. Through 9 company interviews, 4 archetypes of DD were identified and classified in terms of actors' role and information sharing as well as main adoption drivers from the perspective of a large buyer.

Keywords: Dynamic Discounting, Supply Chain Finance, Trade Credit, Working Capital Management

Introduction

In the peak of the recent economic and financial crisis, corporate defaults were common. The substantial underestimation of default risks up to 2007 led to massive downgrades of both sovereign and corporate ratings (deHaan, 2017; Niepmann and Schmidt-Eisenlohr, 2017a) and, overall, a significant negative effect on international trade (Niepmann and Schmidt-Eisenlohr, 2017b), especially through a restriction of trade finance facilities towards more risky parties (Asmundson et al., 2011). Liquidity-scarce companies tried to compensate the contraction in bank lending through a stronger lean focus towards working capital, i.e. increasing payment terms towards suppliers and / or reducing settlement terms with customers (Klapper and Randall, 2011; Martínez-Sola et al., 2017) or even exacerbating cutbacks in inventory levels (Bendavid et al., 2017). However, trade credit in itself cannot fully compensate the contraction of bank lending stemming from the financial crisis (Love, 2011).

As a consequence, liquidity shortages hit corporates, creating chain effects: lost payments propagate from a company to its suppliers (Raddatz, 2010). Evidence shows that the propagation effects of liquidity shortages tends to stop only when it faces a large, cash-rich firm, for example a retailer with a negative cash-to-cash cycle (Boissay and Gropp, 2007). Propagation to suppliers is only one of the effects of liquidity shortages. Studies show that trade credit defaults have also a downstream propagation effect: liquidity shocks likely induce a reduction in trade credit provided to other customers, increasing default risk and involuntary payment delays (Coricelli and Masten, 2004). This context, sometimes referred to as “trade

credit default chains" (Boissay and Gropp, 2007; Coricelli and Masten, 2004) greatly contributed to the development of policies and financial schemes through which large, cash-rich, companies can facilitate access to liquidity to cash constrained, usually SMEs, suppliers (Boissay and Gropp, 2007). Most authors identify this concept as Supply Chain Finance (SCF, e.g. Pfohl and Gomm, 2009; Randall and Farris II, 2009; Seifert, 2010).

However, empirical evidence on SCF is still vastly focused on the most well-known schemes and products (most notably, Reverse Factoring, e.g. Dello Iacono et al., 2015; Lekkakos and Serrano, 2016; Liebl et al., 2016). As practitioner turn their attention to alternative schemes, such as Dynamic Discounting (DD), this raises scientific questions related to its adoption, drivers, benefits and overall relevance as a working capital management tool. Therefore, the objective of this paper is to investigate the adoption of DD solutions through a multi-case study approach involving both providers and large buyers, in order to cast a light on the existence of different archetypes of DD and provide a framework for the drivers influencing the choice of large companies regarding this SCF scheme. The remaining of the paper is organised as follow: the second section present relevant theoretical background, while the third describes objectives and methodology of this contribution. The fourth and fifth sections presents the results of this model: DD archetypes and drivers of its adoption, while the sixth and final session concludes the paper.

Literature review and research goal

Evolution of Supply Chain Finance

SCF has been defined in many ways: as a set of financial solutions (Chen and Hu, 2011), as an advanced form of Reverse Factoring (Wuttke et al., 2013b) or, more broadly, as the inter-company integration and optimisation of financial processes in the supply chain (Caniato et al., 2016; Gelsomino et al., 2016; Pfohl and Gomm, 2009). For the scope of this paper, SCF can be defined as the optimisation of the flows and allocation of financial resources in a supply chain with the aim to increase value, requiring the collaboration of at least two primary supply chain members, possibly facilitated by external service providers (de Boer et al., 2015). Literature on SCF presents two main perspectives: a financial- and a supply chain-oriented one (Gelsomino et al., 2016). The first focuses on the optimisation of account receivables and payables only (Lamoureux and Evans, 2011; Wuttke et al., 2016, 2013a), while the second, adopted in this contribution, expands such focus to a broader set of concepts related to working capital (e.g. collaborative inventory optimisation to reduce working capital needs, as in Randall and Farris II, 2009) or even fixed asset financing (Hofmann, 2005; Pfohl and Gomm, 2009).

As testified by the nature of the two perspectives, SCF is positioned at the intersection of supply chain management and finance (Hofmann, 2009, 2005; Pfohl and Gomm, 2009). While from supply chain management literature it draws concepts such as collaboration and information sharing, one of the main contribution from financial literature comes from trade credit. Trade credit is as a short term business loan from a supplier allowing its buyer to delay payments (Lee and Rhee, 2011). Contributions focused on trade credit are plentiful and long precede SCF itself (Chang et al., 2008; Seifert et al., 2013; Soni et al., 2010). It is recognised that the concept of trade credit is strictly related to SCF (Basu and Nair, 2012; Klapper and Randall, 2011). Trade credit is the most important source of short-term external finance for firms and, in its essence, it is used in two basic forms: a simple delay in payment, or a two-part term policy (also known as cash discount policy), in which the supplier allows the buyer to settle payment within a short term (e.g. 10 days) in exchange for a discount (e.g. 2%), or within standard payment terms for the total nominal value (Lee and Rhee, 2011).

Trade Credit motives

DD evolved from cash discount practices typical of trade credit. However, cash discounts translate to Annual Percentage Rate (APR) that easily exceed 40%, which is considerably higher than the average cost of debt, even for non-creditworthy suppliers (Chludek, 2011; He et al., 2010). Therefore, it has value to analyse motives behind cash discount approaches and (secondarily) trade credit itself. Among the six main suppliers motives for accepting trade credit (for more information and a detailed analysis of trade credit literature, cf.: Seifert et al., 2013), we will focus on the one that are relevant for either the typical supply chain context of DD (relative small suppliers and large buyer) or that tackle specifically on cash discount policies: capital access, product market position, credit information and non-salvageable investments. *Capital access:* large corporates have usually lower costs to access finance and might share this with smaller supply chain partners, e.g. a large supplier might accept trade credit to lower small customers financial burden (Schwartz, 1974). More recently, contributions show how trade credit is in fact a form of financing with high costs, with companies with a weaker credit position using cash discount policies to access liquidity (Hill et al., 2017). *Product market position:* small firms are usually characterised by higher costs of external financing and also by less opportunities to benefit from economies of scale. Consequently, trade credit can become an important tool for building stable relationships and capturing new businesses (Wilson and Summers, 2002). More recently, trade credit has being connected with the possibility for small firms of eliminating financially weaker competition while avoiding margin-erasing price competition (Peura et al., 2017). *Credit information:* financial institutions may find more profitable to "indirectly" lend money through trade credit, rather than direct loans (Jain, 2001). Financial institutions save in monitoring costs by exploiting a large buyer or supplier knowledge on smaller, opaque supply chain partners. Although in the context of trade credit such motive is mainly addressed from a large-supplier small-buyer perspective (Seifert et al., 2013), literature on well-known SCF solutions (such as reverse factoring) highlight this point as well (Klapper, 2006). *Non-salvageable investment:* Smith (1987) suggests that suppliers should adopt cash discount practices in order to monitor the buyer's default risk. A buyer not able to accept an early payment proposal (usually carrying a significant return on cash) can be interpreted as a sign of financial struggling and as the need of close monitoring. From a modelling point of view, cash discount policy can be introduced to reduce the risk of a supplier of incurring in bad debt (Chuang and Wu, 2017).

From the demand side, buyers' motives for trade credit requests are usually triggered by transaction pooling and/or credit rationing (Seifert et al., 2013), while cash discount policies are usually motivated (on the buyer side) by the specific return on cash that they can generate (Chuang and Wu, 2017; Luo and Zhang, 2012).

From Trade Credit to Dynamic Discounting

As discussed above, DD takes root from the cash-discount policy typical of trade credit practices and, through a proper use of a buyer-supplier integrated platform, allows the dynamic settlement of invoices (Polak, 2012). DD arises as it is recognised that 'mass application' of static discount policies precludes potential profits gained through the 'customised' application of early payment discounts (Randall and Farris II, 2009). The flexible use of cash discount policies, when buyer and supplier can agree on settle an invoice at any given time within standard payment terms in exchange for a proportional discount provide, overall, higher total benefits to companies involved (Zhou et al., 2013). According to He et al. (2010), DD can either be buyer-initiated (i.e. the buyer declare the acceptable discount rate and the supplier reacts by accepting early payments) or supplier-initiated (i.e. the supplier suggests competitive discount and the buyer accepts the proposal).

Authors agree that a proper DD application requires an IT platform (Gelsomino et al., 2015; Nienhuis et al., 2013). More specifically, DD is considered to be a "three-corner" SCF model (i.e. models that involve a buyer, a supplier and a third party, which can be a financial institution

or an IT service provider), and a common schema that lets SMEs, suppliers of an anchor buyer, fast access cash at acceptable rates (Nienhuis et al., 2013; Polak, 2012; Polak et al., 2012). As the benefits for the buyer rely on the discount realised, the supplier mitigates the cash flow-in uncertainty, as well as increases trust and cooperation among supply chain players (Templar et al., 2016). DD has received great attention from practitioners. Recent SCF market analyses devote considerable attention to this programme and to the providers offering it (BAFT et al., 2016; GBI, 2016, 2013; The Paypers, 2014). However, although the interest in the topic seems to be high, no attempts have been carried out so far to cast a light on its main application archetypes or drivers for its adoption. Thereby, the overall objective of this contribution is to address the literature gap related to the lack of knowledge and empirical evidence on the different "archetypes" of DD, as well as over drivers of adoption by large buyers. Consequently, the paper identifies two Research Questions:

RQ1. What are the characteristics of the main DD archetypes currently available in the market?
RQ2. What drivers influence a buyer choice between different archetypes?

Research methodology

Case study design

Research on Dynamic Discounting is clearly at an exploratory stage: even though the interest from the business world is remarkable, scientific contributions are scarce and focused exclusively on traditional understanding of the concept streaming from trade credit literature, with extremely limited empirical evidence and little consideration of new practices enabled by the digitalisation of the trade process. Thus, exploratory case studies are considered appropriate for this context, as the theoretical foundation is rather weak (Edmondson and Mcmanus, 2007). Even though the study is mainly based on an inductive approach, its general constructs, key variables and their relationships are still grounded in the theoretical domains that underpin the development of DD – namely, SCF and trade credit (Voss et al., 2002). More specifically, from previous literature it is possible to identify four macro-variables: actors' role, information sharing, strategic objectives, and relationship status. These four macro-variables allowed to develop a preliminary structure of the research and led to the phase of data collection. Coherently with the iterative nature of this process, the collection of data allowed to correctly identify the operationalisation of the different variables. Annex A links presents the theoretical grounding of the macro-variables, together with their operationalisation in the context of the model presented in this paper, as described in the remaining part of this section.

Data collection and analysis

A multiple case studies methodology has been adopted, where the unit of analysis selected is the DD solution: the unit of analysis was the proposed solution for technology providers and the solution adopted or under investigation for buyers. This allows to strengthen the result generalisability and to perform an exhaustive cross-case analysis of the relevant variables (Voss et al., 2002; Yin, 2009). The sample selected is heterogeneous, allowing the collection and comparison of different points of view on the same applications. Overall, nine companies have been object of interviews: six global service providers offering different archetypes of DD, one buyer with a DD solution implemented and two buyers without a DD solution in place (Gibbert et al., 2008). The sample heterogeneity allows to combine insights form providers regarding their own DD offer with the one of buyers that have decided to either adopt or not adopt DD. Characteristics of companies interviewed are reported in Table 1.

For data collection, each interview has been recorded and transcribed, as well as developed into schemes and summaries. Triangulation has been performed through secondary data sources such as internal presentation shared by the interviewees, available commercial material and other relevant pieces of information. Coding followed a two steps approach: open coding to

identify relevant categories based on the four macro-variables identified from literature, and axial coding, to identify and connect together specific constructs from data collected (Voss et al., 2009). Overall, coding generated 12 detailed variables, which are described in Annex A. The identification of those 12 variables allowed to perform cross-case analysis, with the goal of identifying cross-case patterns in the data collected through two-dimensional tables crossing the variables identified (divided per RQ) and the sample of cases. The complete cross-case analysis can be found in Annexes B and C, and are presented and discussed in the following sections of this paper.

Table 1: characteristics of the interviews carried out

Role	Name	Industry	Headquarters	Market served	Interviewee
Providers	P1	Financial services	USA	Global	Director business development
	P2	Financial services	Germany	Global	Sales manager
	P3	IT and financial services	USA	Global	Global account manager
	P4	Financial services	Finland	Nordics, Netherlands and North America	Head of financing product line; Analyst
	P5	Financial services	USA	Global	Strategic account executive
	P6	IT and financial services	USA	Global	European marketing director
Buyers	B1	Chemical	Netherlands	Netherlands	Financial administration
	B2	Chemical	Germany	Global	IMS purchasing director; Global purchasing director
	B3	Consumer electronics	Netherlands	Global	Procurement finance business partner

Archetypes of Dynamic Discounting (RQ1)

Through the cross-case analysis reported in Annex B, we answered to the first research questions. The case studies allow us to identify the main archetypes, in terms of actors involved, roles of different actors and information sharing.

All the service providers in the sample offer Dynamic Discounting solutions, which are characterised by a great level of customisation. However, all the different versions available can be traced back to four main archetypes: Standard Dynamic Discounting; Dynamic Discounting with Third Party Financier; Dynamic Discounting with SPV (Special Purpose Vehicle); Dynamic Discounting through Market Place. Table 2 is summarizing the main features of each archetype; each model is then described in the following paragraphs.

Table 2: Description of the Dynamic Discounting archetypes

		Standard DD	DD with 3PF	DD with SPV	DD through Market Place
Actors' role	Actors involved	Buyer; Supplier; Platform	Buyer; Supplier; Platform; Bank	Buyer; Supplier; Platform; SPV	Several buyers; several suppliers; platform
	Main actor	Buyer-centric	Three corner model	Three corner model	Supplier-centric
	Discount rate responsible	Buyer	Service provider	Service provider	Supplier
	Targeted return	Buyer has a targeted return	Buyer has not a targeted return	Buyer has a targeted return	Buyer has a targeted return
	Discount rate discrimination	Buyer	Service provider	Service provider	Supplier
Information sharing	Supplier awareness	Full supplier awareness	Partially aware	Not aware	Full supplier awareness

	Buyer visibility	Full visibility on single discount rate (single)	Personalized on the basis of customer requests	Visibility on the package made by several invoices (aggregated)	Visibility on the package made by several invoices (aggregated)

Standard Dynamic Discounting

The first archetype identified has been named "Standard Dynamic Discounting", because it refers to the traditional scheme, which is already possible to find in the existing SCF literature. In this first case, the DD practice is buyer-driven, thus the buyer is in charge of setting the discount rate of the programme. These rates can be either the result of a negotiation process before the on-boarding of the suppliers or they can be a pure choice made exclusively by the buyer. When a supplier agrees to be part of the programme, it can have access to the online platform and it can make a request for an early payment. Then, the buyer pays the supplier at the agreed date in exchange for a discount on the nominal value of the invoice. The discount percentage is based on a sliding scale and the specific value is calculated considering the payment date, the net terms and the discount rates defined during the on-boarding process. The reference scheme of a Standard Dynamic Discounting solution is reported in Figure 1.

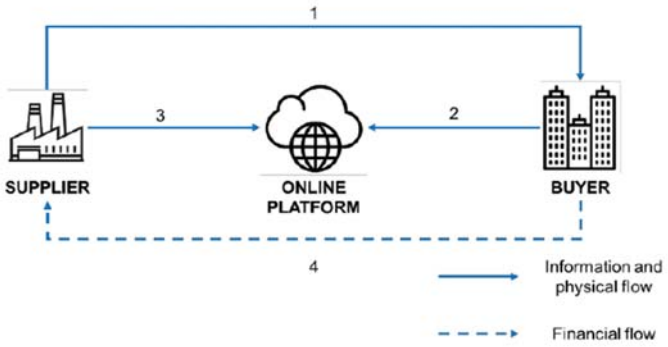

Figure 1: Standard Dynamic Discounting archetype

Step 1. After having received the Purchase Order (PO) from the buyer, the supplier sends the goods required and issues the invoice related to the specific PO.
Step 2. The buyer receives the goods and the invoice and he carries out the typical reconciliation activities in order to verify the coherence between the PO, the goods received and the invoice. When the invoice is approved, it is uploaded by the buyer on the online platform managed by the service provider (with an eInvoicing process, the invoice is already uploaded on the platform before the supplier sends it to the buyer). Finally, a notification is sent to the supplier in order to advise him that early payment is available for that specific invoice.
Step 3. After receiving the notification, the supplier is free to decide when and if to ask for early payment. On the dedicated section of the portal, the supplier can visualize all the invoices already approved and available for funding. Once the request of early financing is made, the buyer receives a notification on the platform.
Step 4. Finally, the supplier receives an amount of money equal to the nominal value of the invoice decreased by the discount provided. As stated before, this discount depends on the tariffs previously agreed during the on-boarding process and it is automatically calculated by the system, according to how many days in advance the payment is required.

Thanks to the interviews performed with the four service providers that offer this specific archetype (P2, P3, P4, and P5.1), it is possible to deepen a couple of aspects, which characterise this solution. First of all, during the process of setting the right discount rates, the buyer has the possibility to perform a supplier segmentation. According to several drivers, such as size of the

spending, location and strategic relevance of the relationship, the buyer can cluster suppliers in order to provide different rates for each different group. For example, P5.1 offers a solution called “Bucketed approach”: suppliers are grouped in different buckets, according to some distinctive drivers, and then the buyer is able to perform a “discount discrimination”, offering higher or lower rates, coherently with the bucket of origin. Secondly, this archetype allows the suppliers to choose between two ways of implementation: the programme can be on an automatic basis or on a manual one. The former approach means that when the suppliers join the platform, they sign an agreement stating the willingness of receiving early financing for all the invoices that are approved. The latter approach means that the supplier is free to choose manually, invoice per invoice, when to ask for an early payment.

Dynamic Discounting with Third Party Financier

The second archetype identified has been named “Dynamic Discounting with Third Party Financier”. The main peculiarity that distinguishes this version from the others is the source of the funding: the buyer doesn’t invest his own excess cash in the programme, but exploits the help of a third party financier (3PF). This particular archetype is provided only P6 because this service provider has a strong strategic collaboration with a preferred third party financier. In order to implement this version of DD, a trusted account needs to be set up at the buyer’s name. This account is then managed by the 3PF, who is responsible for obtaining all the capital required for running efficiently the programme. The funds can either come from banks and other institutional investors or from independent investors, which at maturity receive the return of their investment. The initial three steps are exactly the same than the previous archetype.

Step 4. The request for early payment and the relative information about the supplier and the specific invoice are then sent to the 3PF through the service provider. This phase ends with the invoice approval by the 3PF.
Step 5. The supplier receives the requested early payment from the 3PF, who previously raised enough capital from an investment fund set up at the buyer’s name. The Accounts Receivable value related to that specific invoice remains on the third party financier’s balance sheet until maturity.
Step 6. The buyer pays back the 3PF the full amount on due date. Most of the times, the buyer is able to extend payment terms with suppliers.
Step 7. Depending on the specific horizon of the investment, 3PF delivers the interests matured to the investment fund, while the invoice discount obtained is shared between the three actors involved (buyer, service provider and third party financier).

A distinctive element of this solution is the fact that the buyer has no visibility at all on the discount rates. The buyer is simply required to provide P6 with its suppliers list and with the access to a set of relevant information about them. Then, the service provider enriches these data by using some analytics and by analysing public information as well. Finally, the service provider negotiates the discount rates with all the suppliers during the on-boarding process, coherently with the analysis performed. Once a supplier has agreed to join the programme, the buyer is notified, but the discount rates related to each specific supplier are completely invisible to the buyer, since the whole financing process is managed by the 3PF. Acting in this way, the buyer can avoid appearing as the financing partner of the programme.

The buyer can be completely sure that the service provider would try to maximise the discount rates during the negotiation process with suppliers, because of the logic that stands behind the discount division. Every time that an invoice is discounted, that amount is reduced by the cost of capital from the 3PF and then, whatever is left is shared between the service provider and the buyer. Similarly to the Standard Dynamic Discounting model, also in this situation, the supplier is able to participate to two slightly different versions of the same programme: in the version called “Cash Planner”, every time an invoice is approved, it is automatically sent to the

3PF. On the other hand, even though this version is less frequent, the supplier has the possibility to pick manually the invoice to finance.

Dynamic Discounting with Special Purpose Vehicle

The third archetype is called "Dynamic Discounting with SPV". This specific version is offered only by P5.2 and it exploits the presence of a third party institution, the so-called Special Purpose Vehicle (SPV), which acts as an intermediary between the suppliers and the buyer. A Special Purpose Vehicle is defined as a subsidiary of a company, whose aim is to isolate risk from the parent company. This can be done by maintaining assets and liabilities on a completely separate balance sheet. This archetype can be seen as a combination between a Dynamic Discounting practice and a Reverse Factoring. Suppliers that agree to join this programme have no visibility on the financing source: this solution makes whoever is funding invisible to the suppliers. The first 2 steps are the same for all the archetypes; for this reason, they are not displayed in the scheme.

Step 3. After receiving the notification, the supplier is able to decide when and if to ask for early payment. On the dedicated section of the portal, the supplier can visualize all the invoices already approved and available for funding and the relative rates. Since the supplier has no visibility on the financing source, there are no differences between the rates related to a Dynamic Discounting programme and the ones related to Reverse Factoring.

Step 4. When the supplier makes a request for early payment, two different situations can arise, depending on buyer cash availability.

Step 4.A. If the buyer has personal cash to use, the specific invoice is purchased by SPV and it can be grouped into a package, called note. Each note is built taking into account the buyer and his requests: service provider receives from the buyer information about the amount of cash he wants to invest and the expected return. Then, hundreds of invoices are combined in order to build one note, which is characterised by a specific amount and a return. At the end, the provider sells the note, which has been created in order to meet buyer's expectations. In this case supplier receives the requested early payment from the buyer through SPV, which acts as an intermediary

Step 4.B. If the buyer has currently no excess cash or he is not willing to invest in such programme, or the invoice is not suitable for being included in any note, the supplier can still get the financing through a standard Reverse Factoring solution. In this case, supplier receives the financing from the external financial institution (bank) through the platform, which is involved in Reverse Factoring. In this case, according to the agreements, which characterise the Reverse Factoring solution in place, the buyer pays back the bank at due date.

This archetype is different than a traditional DD practice, because the invoices are actually bought and sold, in an aggregate way, by the service provider. Moreover, since the notes are collateralised by the AR of the supplier and all the invoices, which are part of a specific note, are taken from the supplier base of the buyer, this can be considered as a real risk-free investment. Basically, the buyer is investing his money, being aware that the riskiness of the investment itself depends on whether or not he will pay back his suppliers. Finally, one of the main big advantages of this solution is the possibility for the buyer to keep the anonymity. When suppliers access their dedicated section in the platform, they can see the list of the invoices available for early payment and the relative discount rate, which they have negotiated with Iota during the on-boarding phase. In this way, they are not aware about where the money comes from. This situation can be particularly useful when the buyer is dealing with suppliers that have the same or even bigger size, and, thus, that have a strong negotiating power.

Market Place

The fourth and last archetype is the one proposed by P1 and it is named "Market Place". The logic that stands behind this business model is the belief that a Dynamic Discounting process characterised by rates set by the buyer is an inefficient process. First of all, the buyer cannot be

completely sure about what the supplier is really willing to accept. Moreover, there is not either a traditional negotiation process, since each buyer may have thousands of suppliers and it can be time-consuming. With the intention of creating an additional evolution of Dynamic Discounting practices (which already evolved from cash discount policies), this archetype has created a dynamic real-time environment for companies, where needs of the suppliers are matched with requests of the buyer. In order to generate the appropriate market place, this archetype completely switched from traditional practices, where the buyer or the service provider were in charge of setting the discount rates of the programme, to a supplier-led solution, where the supplier is the only responsible for it.

The web-based platform is not a unique global market, but it encompasses several markets. The main reason for the presence of multiple markets is inside the concept of supply chain itself: one supplier has multiple buyers, and the platform provides one market for each of those buyers. Likewise, one buyer has many suppliers, who are willing to unlock cash for their businesses. When the supplier logs on the dedicated section of the platform, he has full visibility on all the available invoices, which have been already approved by the buyers after the usual reconciliation process. Then, supplier is able to decide the discount rate that wants to provide. The system automatically calculates the amount of the discount, considering the proposed rate, the days paid earlier and the nominal value of the invoice. If the supplier is satisfied, it can save the settings and wait until the end of the day, otherwise can still change the proposal anytime during the day. On the buyer's side, when buyer logs on his dedicated section, the parameters to set are the amount of cash buyer wants to invest and what return is willing to reach with this investment.

Then, the market place runs on a daily basis: at the end of the day, the platform, thanks to an appropriate algorithm, is able to match what the suppliers require with what the buyer is ready to invest. The following day, each supplier can decide whether to keep proposing the same discount rate (in the case it received the early payment) or to increase the rate (in the case it couldn't receive the money). However, this model is positive not just for the supplier but also for the buyer. The market place is able to create appropriate packages by combining invoices from different suppliers with the final aim of satisfying the targeted return that the buyer sets, because the algorithm works taking into consideration a "blended rate". It is possible to accelerate payments also for suppliers who are proposing rates lower than the targeted return, on condition that they are balanced by other suppliers who propose higher rates. Another advantage for the buyer is the possibility to define a targeted return on a monthly basis instead of a standard daily basis.

Drivers of adoption of Dynamic Discounting Archetypes (RQ2)

In this section, the RQ2 is investigated, to identify some possible drivers of adoption in the buyer perspective. Looking at the academic literature, it is still not clear how companies can understand which one, among the existing Dynamic Discounting archetypes, is the right version to implement. Through the case studies, we were able to better specify the main drivers identified through the literature, as well as to customize the value of those drivers for the four archetypes identified. The summary of the main drivers for each archetype is reported in Table 3, cross case analysis is reported in Annex C.

Table 3: Description of the drivers of the Dynamic Discounting archetypes

Macro-variables	Variables	*Standard*	*3Party financier*	*SPV*	*Market place*
Strategic objectives	Strategic goal	Buyer financial performance	Combination	Combination	Buyer financial performance
	Tangible benefit (discount)	2%-5% in average	2-6% in average	8-10% in average	6-7% in average
	Intangible benefits	Risk management and non salvageable investments	Improvement of DSO metrics	Expanding business tool	Improvement of DSO metrics Expanding business tools Time factor
Relationship status	Targeted suppliers	Long tail	Whole supply base	Whole supply base	Whole supply base
	Implementing and switching cost	Minor	Minor	Significative	Significative

Interviewed companies have addressed three main variables in terms of strategic objectives. First of all, the main goal to introduce DD, that might be just a new solution used by the buyer to improve its personal financial performance or it could also be a tool to strengthening the relationships along the supply chain. Considering the DD with 3PF, the main goal is to exploit as much as possible the benefits that arise from an invoice discount and from an extension of payment terms, thus the focus is more on improving his own financial performance. Similar approach was also identified for the case of Standard DD, where most of the service providers addressed that buyer is mainly focused exclusively on its personal return, trying to get the highest possible discount. In DD with SPV and Market Place configurations, the buyer tries to achieve a better financial position, but paying attention not to stress the relationship with suppliers.

The second variable mentioned by interviews pertain to the expected results, in terms of discount. This variable is mainly specific of the specific service provider, but looking at the main replies achieve through the interviews, it was possible to identify some average value for each archetype. In this sense, the most convenient solution appears the SPV, that can bring quite high level of discount return, thanks to the ability of the SPV itself to arrange and combine different options for the buyer.

The third variable mentioned in the interviews pertain to some intangible benefits, beyond the discount. In particular, interviews identified 4 main intangible benefits, with different elements of important for the four archetypes. For standard DD, the most important element pertains to risk management: two service providers stated the importance of maintaining a stable and sound relationship, especially if the supplier has made some relationship-specific investments. For the 3PF, it is particularly relevant the potential improvement of DSO metrics. As a matter of fact, some service providers as well as companies part of the research addressed that close to the end of the business year, suppliers may accept/propose discount rates, which are characterised up to 10% variance, compared to other moments of the year. This benefit was raised also by the service provider offering the market place solution, which is the approach more supplier-centric. The SPV archetype reported as additional benefit the use of the solution as a expanding business tool. In particular, the need of building or increasing the customer base is especially common for start-ups, which may be innovative and well-performing, but constrained by liquidity problems. This benefit as well was also reported by the service provider offering the market place solution. Finally, the market place archetype reported also an additional benefit, related to time factor. They especially reported the flexibility of the platform proposed and so the possibility to avoid time consuming legal agreements and thus to have quick access to financing.

Considering the relationship status, the first variable investigated pertains to target suppliers. It investigates which group of suppliers the buyer should target for the on-boarding process. Considering also the findings from the existing literature, the Standard DD is often coupled with a Reverse Factoring solution independently (not part of the DD archetype). This means that the buyer usually implements DD with the suppliers belonging to the so-called long tail, and RF with top suppliers. On the other hand, the three remaining configurations have in common the possibility for the buyer to target the whole supplier base, because Reverse Factoring is often embedded into the archetype itself.

The last variable taken into consideration pertains to expenses for the implementation of a DD solution and the effort for switching from a SCF solution to another within the same online platform. Considering the Standard DD, there are no significant costs, but just some small expenses about vendor communication, setup activities and creation of new documents and agreements. Moreover, switching from one solution to another is pretty simple, since they usually share the same service provider's platform. Also for a DD with 3P Financier, the implementing costs are quite low, since this solution just requires simple setup activities and agreements. On the other hand, the costs for putting in place a DD with SPV can be significant: they entail legal expenses and external counselling in order to setup a dedicated compartment in the SPV. Finally, the Market Place implementation costs can be considered as well to be quite significant, since this archetype is a more complicated construct and it requires more documentation than a simple one-page legal agreement typical of the first two archetypes.

Conclusions

This paper aims at investigating a key SCF solution, namely Dynamic Discounting. Through the support of a multiple case studies methodology, four DD archetypes were identified: each archetype is characterized in terms of actors' role and information sharing. Each archetype was also investigated in terms of drivers (i.e., strategic objectives and relationship status) for the adoption, with a buyer-centric perspective.

The paper presents some contributions both from a research and a practitioner perspective. For the former, literature about DD is poor, especially in terms of empirical contribution. The paper cast some lights on practical implementation of DD, illustrating the main archetypes with the support of an empirical basis. Moreover, literature is investigating DD as a stand-alone solution: the proposed archetypes show that on the one hand different models are existing under this concept and on the other hand the adoption of DD might be synergic with other SCF solutions, i.e. Reverse Factoring. For the latter, the paper provides an overview about the possible models to introduce DD into companies, helpful for managers investigating it. The identification of the main drivers for each archetype might also be a suitable tool, supporting the decision-making process.

The paper has also some limitations, that can open up opportunities for further research. First of all, most of the evidence comes from the analysis of major technology providers case: the sample should be enlarged, including also the perspective of small technology providers, reinforcing the viewpoint of big buyers and introducing the perspective of suppliers. Second limitation is that just the buyer perspective was taken into consideration for the identification of drivers: further research might aim at analysing the problem with the supplier perspective too. Thirdly, the paper just addressed the strategic objectives behind the choice: additional research will aim at quantifying potential benefits achieved through the solution. Finally, the cases hint the potential combination of DD with other SCF solutions, such as the adoption of Reverse Factoring for strategic suppliers and those of DD for the "long tail" of suppliers. Additional research might investigate the potential combination of different tools, to exploit all the value of SCF for both buyers and suppliers.

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RQ	Macro-variables	Description	References	Operationalisation
RQ1	Actors' role	In both trade credit and SCF literature benefit and adoption drivers depend on role, responsibilities and balance of power between actors	Fabbri and Klapper (2008); Gelsomino et al. (2016); Wuttke et al. (2013a)	Actors involved
				Main actor
				Discount rate responsible
				Targeted return
				Discount rate discrimination
	Information sharing	Scheme adoption is affected by visibility on information flows and presence of information asymmetry	Luo and Zhang (2012); Pike et al. (2005); Wu et al. (2016)	Supplier awareness
				Buyer visibility
RQ2	Strategic objectives	Buyer adopts SCF schemes with different strategic objectives (mainly: working capital optimisation or risk reduction)	Caniato et al. (2016); Wuttke et al. (2013b)	Strategic goal
				Tangible benefit (discount)
				Intangible benefits
	Relationship status	Strategic relevance of the relationship, collaboration is a keystone concept of SCF	Caniato et al. (2016); Hofmann (2005); Pfohl and Gomm (2009)	Targeted suppliers
				Implementing and switching cost

Annex A: variables in the conceptual framework

Macro-variables	Variables	P1	P2	P3	P4	P5.1	P5.2	P6
Actors' role	*Actors involved*	Several buyers; several suppliers; platform	Buyer; Supplier; Platform	Buyer; Supplier; Platform	Buyer; Supplier; Platform	Buyer; Supplier; Platform	Buyer; Supplier; Platform; SPV	Buyer; Supplier; Platform; Bank
	Main actor	Supplier-centric	Buyer-centric	Buyer-centric	Buyer-centric	Buyer-centric	Three corner model	Three corner model
	Discount rate responsible	Supplier	Buyer	Buyer	Buyer	Buyer	Service provider	Service provider
	Targeted return	Buyer has a targeted return	Buyer has a targeted return	Buyer has a targeted return	NA	NA	Buyer has a targeted return	Buyer has not a targeted return
	Discount rate discrimination	Supplier	Buyer	NA	NA	Buyer	Service provider	Service provider
Information sharing	*Supplier awareness*	Full supplier awareness	NA	NA	Full supplier awareness	Full supplier awareness	Not aware	Partially aware
	Buyer visibility	Visibility on the package made by several invoices (aggregated)	NA	Full visibility on single discount rate (single)	Full visibility on single discount rate (single)	Full visibility on single discount rate (single)	Visibility on the package made by several invoices (aggregated)	Personalized on the basis of customer requests

Annex B: cross case analysis about Dynamic Discounting archetypes

Macro-variables	**Variables**	**P1**	**P2**	**P3**	**P4**	**P5.1**	**P5.2**	**P6**
Strategic objectives	*Strategic goal*	Combination	Combination	Buyer financial performance	Buyer financial performance	Buyer financial performance	Combination	Buyer financial performance
	Tangible benefit (discount)	Min: 0% Average: 6-7% Max: 25%	NA	Max: 8%	Min: 5% Max: 35%	Min: 1% Average: 8-10% Max: 20%		Average: 2-4-6%
	Intangible benefits	Improvement of DSO metrics Expanding business and marketing tool Time factor	Risk management and not salvageable investments	Risk management and not salvageable investments	Time factor		Expanding business and marketing tool	Improvement of DSO metrics
Relationship status	*Targeted suppliers*	Whole supply base	Long tail	Long tail	Long tail	Whole supply base	Whole supply base	Whole supply base
	Implementing and switching cost	Significant	NA	Minor	Minor	NA	Significant	Significant

Annex C: cross case analysis about drivers

Supplier Communications during Production Ramp-up: What can Procurement do to improve Ramp-up Performance?

Claudia Gesell[1], Andreas H. Glas[2] and Michael Eßig[2]
1 Audi AG, Germany
2 Bundeswehr University Munich, Germany

Abstract
Ramp-up, defined as the period between the completion of development and a stabile serial production, is of high importance for the success of manufacturing companies. Supplier communication is repeatedly mentioned in the literature as a source for improving ramp-up performance. Therefore, the aim of this paper is to conceptualize the exchange of information between a buyer and a supplier to improve the understanding of the communication during the ramp-up process. For this purpose, a systematic review of the literature is used to analyze the status quo of existing communication concepts in ramp-up management. The paper conducts a content analysis of a sample of 86 subject-relevant articles from academic journals. Surprisingly, although communication plays a central role in ramp-up management, only a few limited and specific findings were discovered. In the ramp-up literature, communication is only mentioned but is not further expounded upon. Hence, this paper identifies research gaps in the communication literature regarding ramp-up management and proposes a novel potential direction for future research.

Keywords: communication, ramp-up management, buyer-supplier relationship

Introduction

The period between the end of product development and full capacity production is known as production ramp-up (Terwiesch and Bohn, 2001). Production ramp-up is a crucial phase for a number of reasons. Surbier et al. (2014) identify time, costs, complexity, and uncertainty as reasons, why almost every company faces problems related to new product introduction, in the short or medium term. To illustrate these issues, this work introduces the topic of supplier communication during production ramp-up with an example from the automotive industry.
In general, the automotive industry is currently characterized by increasing customer requirements with respect to the quality and individualization of products (Thiebus et al., 2006). Therefore Original Equipment Manufacturers (OEM) create new car segments, such as Sport Utility Vehicles (SUV), and enrich existing segments with more individualized possibilities (Thiebus et al., 2006). Likewise, new technology, such as the development of electro mobility during the next ten to 15 years, will increase the number of new models. Model diversity increases significantly. For example, AUDI AG, a German automotive manufacturer, had three models in 1980 but is expected to have 17 models by 2025 (Gesell 2017; Jung, 2017). Customization and new technologies increase model quantity, which leads to more frequent ramp-up processes. However, 33% of all ramp-ups today do not reach their cost targets, and 50% do not reach their technical targets (Bauer et al., 2014; Bischoff, 2007). Therefore, production ramp-up affects both successful serial operations and commercial success (Bauer et al., 2014). It can be assumed that the success of the production ramp-up affects the performance of the whole product introduction project.
Production ramp-up is also a topic in purchasing and supply management; even though the ramp-up phase affects numerous functions in a company, such as marketing, finance, and sales, the most related ones are product development, production planning and supply chain functions (Surbier et al., 2014). OEMs externalized a wide range of development and production tasks to suppliers that formerly might have been carried out in-house (Hab and Wagner, 2017; Jung,

2017). This means, that OEMs focused on their core competencies, and for other activities, they draw on the expertise of suppliers (McIvor and Humphreys, 2004). It is the task of the supply management functions of a company to coordinate with the suppliers during production ramp-up and to be the interface to the upstream market (Calabrese, 2000).

Production ramp-up has been studied by numerous researchers since the late 1990's, but the literature addresses a wide range of topics, such as planning, knowledge management, personnel management, and product change management (Surbier et al., 2014). It seems as if there was no distinct focus on the role of the procurement department and the opportunities provided by an improved buyer-supplier coordination. However, both academics and practitioners underline the importance of coordination and information sharing in buyer-supplier relationships (Baglieri et al., 2007; McLoughlin and Horan, 2000). Generally, the communication during production ramp-up is identified as an important success factor (Bauer et al., 2014; Filla and Klingebiel, 2014). The high relevance of supplier communications during production ramp-up was the starting point of this research to further investigate how the communication interface has already been analyzed.

Very few articles have been found that explicitly address the topic. A recent literature review by Surbier et al. (2014) on the status-quo of production ramp-up research mentions the aspect of "cooperation between personnel, departments, and companies," but it only cites two references (Surbier et al., 2010; Kuhn et al., 2002). This is surprising, as product introduction is a topic for almost every manufacturing company, and production ramp-up will increase in many industries due to short product life cycles and customization. It has been assumed by the authors that there must be more knowledge about the phenomena in the literature. The following guiding research question was considered by this present study.

RQ: What is the status quo of purchasing-driven supplier communications in ramp-up management?

To answer this research question, a structured review of the literature is executed with a distinct focus on buyer-supplier communications and production ramp-up. The level of analysis is dyadic and analyzes the relationship between buyers and suppliers. This article reports on this review, and the remainder of the article is organized as follows. After this introduction, an analytical framework is formulated in order to evaluate the literature according to the dimensions of that framework. Next, the methodology is outlined in section 3 and provides details of the literature review. This is followed by section 4, in which the findings of the review are presented. Finally, the results are discussed in section 5. The article ends with concluding remarks and identifies areas for future research.

Supplier communications in ramp-up management: An analysis framework

To ensure a common understanding of ramp-up management and supplier communications, the following section introduces both topics. On that basis, this chapter synthesizes both aspects and develops an analytical framework. This, structures the topic and allows for further analysis of the literature according to the dimensions of that framework.

Review of ramp-up management

The focus of this article is on the production ramp-up in which there is great coordination between buyers and suppliers. Therefore, ramp-up is a critical phase of the entire product life cycle (Surbier et al., 2014; Thiebus et al., 2006). Production ramp-up is the primary issue and has its routes and origins of discussion in the new product development literature. Indeed, ramp-up is defined as the last step of the new product development process (Surbier et al., 2014). There is a general consensus on the definition of ramp-up in the literature. The first definition given by Bohn and Terwiesch (1999) was adopted by later studies. Ramp-up refers to the period between the completion of development and full capacity utilization (Bohn and Terwiesch, 1999). Therefore, ramp-up is the linking process starting with the release for development and ending at the subsequent serial production phase (Surbier et al., 2010; Thiebus et al., 2006).

Ramp-up management can be divided into phases. The three frequently mentioned phases are the pre-series, the pilot series and the ramp-up phase (Kremsmayr et al., 2016). The pre-series phase is the only phase where series tools are not used. The objective is to identify potential spheres of action and to qualify the personnel (Bußwolder et al., 2016). In the following pilot phase, all tools, materials, and staff are the same as in the series production (Thiebus et al., 2006). Suppliers also start ramping up their parts. The last phase is the ramp-up phase during which the first products are sold to customers (Bußwolder et al., 2016; Winkler et al., 2007). Furthermore, the ramp-up phase is characterized by the demand of increasing production output from the customer side and ends at the production of a predefined volume (Kremsmayr et al., 2016; Surbier et al., 2010).

The most common characteristics of ramp-up come from Surbier et al. (2014) and, are summarized below.

- There is low initial knowledge about the product and processes (Fleischer et al., 2003; Juerging and Milling, 2006; Terwiesch and Xu, 2004). Learning gradually occurs (Terwiesch and Bohn, 2001; Terwiesch and Xu, 2004; van der Merwe, 2004) but is difficult (Haller et al., 2003; Säfsten et al., 2008).
- Low production output (Fleischer et al., 2003; Haller et al., 2003; Juerging and Milling, 2006; Terwiesch and Bohn, 2001).
- Higher cycle time (Haller et al., 2003; Terwiesch and Bohn, 2001; Terwiesch et al., 2001).
- Low production capacities (Fleischer et al., 2003; Haller et al., 2003; Juerging and Milling, 2006; Terwiesch and Bohn, 2001; Terwiesch et al., 2001).
- High demand (Haller et al., 2003; Terwiesch and Bohn, 2001; Terwiesch et al., 2001).
- High disturbance in process, supply chain or product quality (Fjällström et al., 2009; Fleischer et al., 2003; Terwiesch et al., 2001).
- Lack of planning reliability (Meier and Homuth, 2006).

One of the most important activities in ramp-up management is the discovery and removal of problems and missed opportunities (Terwiesch et al., 2001). Any interruptions or problems during ramp-up have negative impacts on efforts and costs and could turn the whole project from a success into a loss (Surbier et al., 2014). Often, ramp-up is considered as a project, such as a temporary endeavor to transform a unique product introduction into series production (Juerging and Milling, 2006). Therefore, the performance indicators are mostly derived from the classical project performance measures, such as the “magic triangle” of costs, quality and time (Surbier et al., 2014). In summation, ramp-up management covers all main activities related to planning, executing and controlling a production ramp-up, while the objective is to carry out a ramp-up within the planned time frame using high quality processes and cost compliance (Clark and Fujimoto, 1991; Surbier et al., 2010; Terwiesch et al., 2001).

Review of supplier communications

Suppliers involvement early in new product development helps to increase the operational performance of buyers and suppliers; the main benefits are an increase in the synchronization of the supply chain, a deduction of total costs, an improvement of quality and cycle time and a stronger competitive position (Monczka et al., 1998; Monczka et al., 1993; Tan, 2001; Vanpoucke et al., 2014). The topic of involving suppliers in the processes of the buyer is discussed in the literature under the topics of “supplier integration” and “supplier relationship management”. Supplier relationship management is the part of the supply chain management that addresses all aspects of the business relationship between companies and their suppliers (Das et al., 2006; Dwyer et al., 1987; Farmer, 1997; Lamming and Hampson, 1996; Morgan and Monczka, 1996).

In successful purchasing relationships, effective communications are a key factor (Ambrose et al., 2008). Numerous studies of buyer-supplier relationships have identified communication as an antecedent of trust (Morgan and Hunt, 1994) and of relationship success and satisfaction

(Human and Naudé, 2014; Mohr and Spekman, 1994; Monczka et al., 1993). Communication can be defined as "the formal as well as informal sharing of meaningful and timely information between firms" (Anderson and Narus, 1990). Therefore, communication is the process of acquiring all relevant information, interpreting this information and effectively disseminating the information to those who might need it (Crotts and Aziz, 1998). Communication is of vital importance to everyone involved in the purchasing relationship (Emmitt, 2010; Zulch, 2014). Therefore, it could be assumed that effective communication is also relevant for successful production ramp-up. That assumption is supported with some exemplary statements about the importance of communication during ramp-up (Table 1).

Table 1: Exemplary statements about communication during ramp-up

Author	**Statement**
Bauer et al., (2014)	”The start of series production is an interdisciplinary process in which **information and communication flow** play an important role.”
Filla and Klingebiel, (2014)	”Most of the pre-series sub-processes are equivalent to series processes. The main difference is **a higher effort on the communication and information flow** to ensure a new material flow for supplying the pre-series production; especially under consideration of permanently changing components in the product related bill of materials.”
Nau et al., (2012)	”**Communication** has a high weighting factor, because this is usually an important task in all ramp-up projects.”
Surbier et al., (2010)	”**Intense collaboration** and **information exchange** is needed to complete the ramp-up objectives.”

The statements in Table 1 imply that supplier communications during ramp-up may reduce development time, reduce development and product costs and improve product quality both now and in the future. For this reason, this analysis regards communication between the buyers and suppliers. Indeed, the communication (behavior) of companies during ramp-up and other phases is performed by individuals and poses several methodological challenges.
Referring to the methodological individualism, which was introduced as a methodological precept for the social sciences by Weber (1922), all explanations of social phenomena (macro level) have to be couched in terms of statements about individuals (micro level) (Hodgson, 1986). The micro level could be researched through observations or hypotheses testing, but the macro level could not be analyzed. To gain knowledge on the macro level, the insights from the micro level have to be interpreted and aggregated to reveal generalize knowledge. This research follows this reasoning, which allows us to explain social phenomena in terms of individuals and relationships between individuals (Hodgson, 2007).
To structure supplier communications for the analysis of the literature, a basic understanding of communication is used from the huge amount of literature from diverse disciplines on communication. At its most basic level, communication is described by the S-O-R-Model (stimulus-organism-response) (Woodworth, 1921). This model pictures that stimulation and human behavior (reaction, action) are linked by an organismic component (Buxbaum, 2016). This means that the human behavior is usually a complex function of interacting factors. Furthermore, Shannon and Weaver (1964) state that communication consist of the following five components.

- The information source selects a desired message out of a set of possible messages (this is a particularly important remark, which requires considerable explanation later).
- The transmitter changes this message into the signal, which is sent over the communication channel from the transmitter to the receiver.
- The channel is merely the medium used to transmit the signal from the transmitter to the receiver.

- The receiver ordinarily performs the inverse operation of that done by the transmitter to reconstruct the message from the signal.
- The destination is the person for whom the message is intended.

The communicated message flows from the sender. It is encoded through the transmission channel/medium by a verbal or non-verbal method for the receiver that decodes the message (Shannon, 1948; Shannon and Weaver, 1964). Weaver (2007) added one more component, the so-called noise. Noise exists in every communication medium and distracts the receiver from the contents of the message. To ensure effective communication, all components must function to prevent misunderstanding (Zulch, 2014). In other words, content, medium, feedback, and the frequency of communication must be aligned (Mohr and Nevin, 1990).

Analysis framework for supplier communications in ramp-up management

This chapter describes an analysis framework for supplier communications in ramp-up management. Three theories encompass this framework, including social exchange theory, role theory and principal-agent theory.

Social exchange theory states that individuals or groups attempt to interact with others with the expectation of a reward. It assumes that behaviors can be assessed by the rewards of interaction minus the costs of that interaction (Wu et al., 2014; Yang et al., 2009). Role theory focuses on the roles that receivers and senders play in social interactions, which are induced through shared expectations and associated behaviors of different parties within specific contexts (Andersen et al., 2009; Dong et al., 2016). Principal-agent theory argues that there is asymmetric information sharing between dependent actors. Wherever one individual or group depends on the action of another, an agency relationship arises. The individual taking the action is called the agent. The affected party is the principal. The challenge in the principal-agent theory arises whenever the principal cannot perfectly monitor the agent's action and information, which almost always occurs (Pratt and Zeckhauser, 1985). Thus firms in a buyer-supplier relationship can be expected to have access to and possess different information (Oosterhuis et al., 2013).

Based on the above mentioned three theories for supplier relationship management, the three process phases of production ramp-up, and the understanding of communications with the S-O-R-model, the analysis framework synthesizes those mentioned aspects.

Referring to the ramp-up management, the model (see Figure 1) refers to the three phases A to C between development and serial production (Bauer et al., 2014; Fjällström et al., 2007; Surbier et al., 2010; Thiebus et al., 2006). In this paper, serial ramp-up is defined by the three phases of (A) pre-series, (B) pilot series and (C) the ramp-up phase (Bußwolder et al., 2016; Kremsmayr et al., 2016).

Next, the model (see Figure 1) consists of six dimensions that are related to communication. The communication dimensions are classified into (1) behaviors, (2) roles, (3) channels, (4) information type, (5) quality (that in sum build the factors of success of communication), and (6) influential factors and sources of irritation.

The behavior of communication partners is characterized through trust, commitment, and their cultural background (Dwyer et al., 1987; Ireland and Webb, 2007; Large, 2005; McCarter, 2005; Mohr and Spekman, 1994; Moorman et al., 1993; Moorman et al., 1992; Morgan and Hunt, 1994; Rosenbloom and Larsen, 2003; Schurr and Ozanne, 1985). It is based on the social exchange theory and the principal-agent theory. All text in the structured literature review related to behaviors is coded to that communication dimension. Next, communication roles are distinguished and the sender and receiver roles are derived from the role theory (Andersen et al., 2009; Dong et al., 2016), as well as sub-roles (who on the buyer side communicates with who on the supplier side).

The next three communication dimensions are deduced from the model by Shannon and Weaver (1964). The information channel describes how information is exchanged. For example, the literature differs in face-to-face meetings, telephone and e-mail (Mohr and Nevin, 1990; Mohr and Spekman, 1994). The information type characterizes what information is exchanged

(Monczka et al., 1998; Noordewier et al., 1990; Richeson et al., 1995; Samaddar et al., 2006). Communication quality includes aspects such as timeliness, accuracy, reliability and relevance (Chen and Paulraj, 2004; Monczka et al., 1998; Naumann and Rolker, 2000). Finally, the influential and interference factors represent a collective dimension that comprise all other issues that could have an effect on the supplier relationship, communications and ramp-up management.

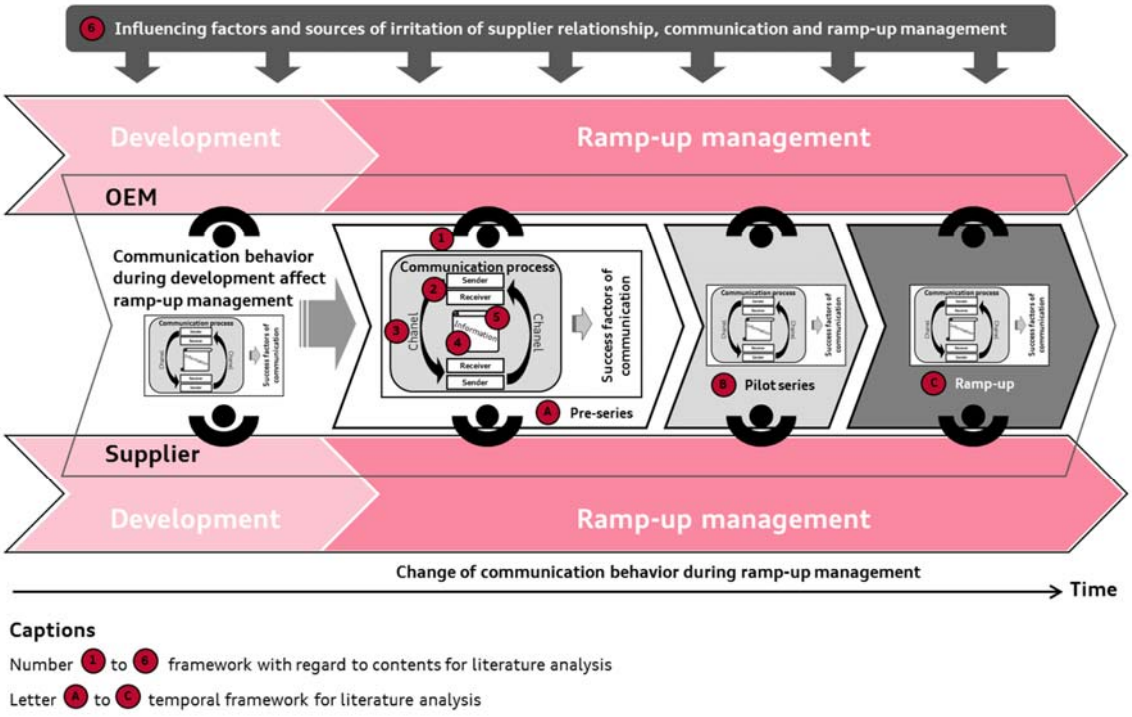

Figure 1: Analysis framework for supplier communication in ramp-up management

Methodology

This paper is based on a systematic literature review. To ensure completeness and reproducibility, it follows the typical methodology of a review (Denyer and Tranfield, 2011; Easterby-Smith et al., 2015). In addition, backward and forward snowballing was used. Snowballing refers to using the reference list of a paper or the citations to the paper to identify additional papers (Wohlin, 2004).

Table 2 gives an overview of how the review was conducted by discovering literature through Science Direct. This database was selected due to its broad coverage of journals across all fields, disciplines and research areas. The keywords for the search were the following: communicat(ion/e/ing), informat(ion/ing) in the area of communications, buyer-supplier and supply chain in the area of supplier management and ramp-up, product launch, and the start of production in the area of ramp-up management.

Table 2: Overview on methodology of literature analysis

Database	SienceDirect
Search	First round: combination of Communication and Ramp-up Management terms: For title/ keywords/ abstract Second round: combination of Communication and Supplier Management terms: For title/ keywords/ abstract exclusion fot the keyword supply chain only for title
Search terms	Combination of Communication, Ramp-up Management and Supplier Management (due to lack of consistent terminology): **Communication:** communicat*, informat* **Ramp-up Management:** ramp-up, product launch, start of production (no hits) **Supplier Management:** buyer-supplier, supply chain (only title)
Language	English
Sources	Journal papers, conference proceedings, textbooks (of all application fields/ disciplines)
Review period	-2017 (using 1997 in the search of previous years did not reveal any significant papers)
Result of analysis	297 papers identified, read and evaluated (based on abstracts and cross reading) 86 papers remained (after exclusion of non-relevant papers)

The first search round was conducted by combining the communication and ramp-up management keywords. As many articles do not have any of the ramp-up management related terms in their titles, keywords or abstracts, (the combinations with the keyword start of production resulted no hits), a second search round was conducted. It focused on the combination of communication and supplier management terms.

Findings

Identified articles

The analysis reveals the status quo of academic attention on supplier communications in ramp-up management. In total, 297 articles were identified through the search strings combining communication with supplier management or ramp-up management terms. Of these articles, 86 were included in this review. There are two main reasons for the high number of rejected and excluded articles. First, articles that solely addressed information technology and its systems were excluded. Second, papers that did not have a connection to communication between partners in the supply chain or communication during ramp-up were also excluded. The review included articles up to the first quarter of 2017 and included early stages of literature, but our analysis did not reveal any significant papers before 1997.

The research suggests that there has been increasing interest in supplier communications during the last seven years, as 60% of the articles were published in the last seven years. However, of the 86 identified articles, only six contain supplier communications in ramp-up management as a focus topic (named key articles in Figure 2). All others have differing main topics but include some scattered, often limited information on communication and information exchange in buyer-supplier relationships or rather generic statements about ramp-up management. Even this initial descriptive analysis of the sampled articles indicates that supplier communications gained scientific interest, but overall, the number of sources is very scarce.

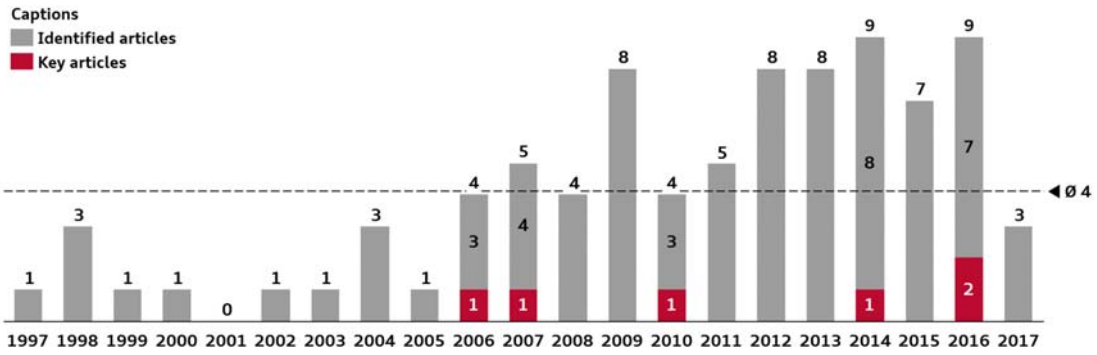

Figure 2: Articles identified as relevant for communication in ramp-up management, shown per year. The key articles are in red.

Next, the findings of the relevant articles suggest a dominance of quantitative methodological approaches. A total of 61 articles (71%) report on quantitative methods. In contrast, of the six key papers three are conceptual, two use qualitative methods and one applies survey methodology (Figure 3).

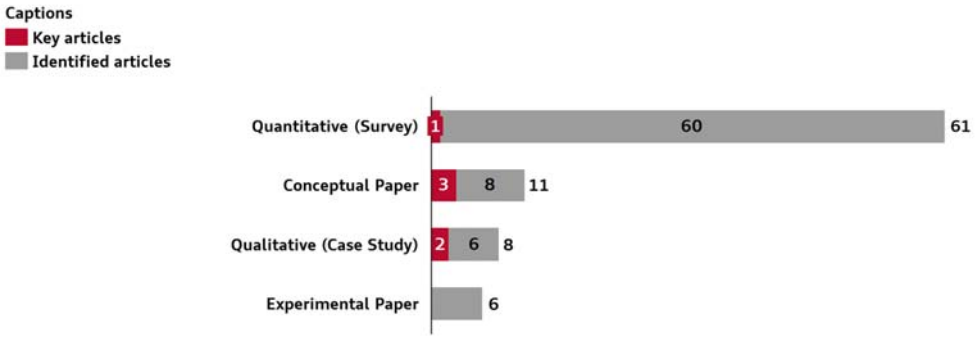

Figure 3: Relevant articles per applied methodology. The key articles are in red.

Findings concerning communication

In a few of the 86 identified articles, there are more than one communication dimension analyzed. The topics of communication behaviors and communication channels are the areas of highest interest, with 56 and 50 codings, respectively. These are by far the highest number of references per topic. Additionally, two categories (information type and communication quality) are discussed and have a significant number of codings (33 and 38). In contrast, the dimension of roles, that describe the relationship between senders and receivers is underrepresented and only addressed in side notes. Only Dong et al. (2016) examines role ambiguity and role conflict as two facets of role hazard between buyers and suppliers. All other topics are addressed, even when most contributions only touch on the topic (Figure 4).

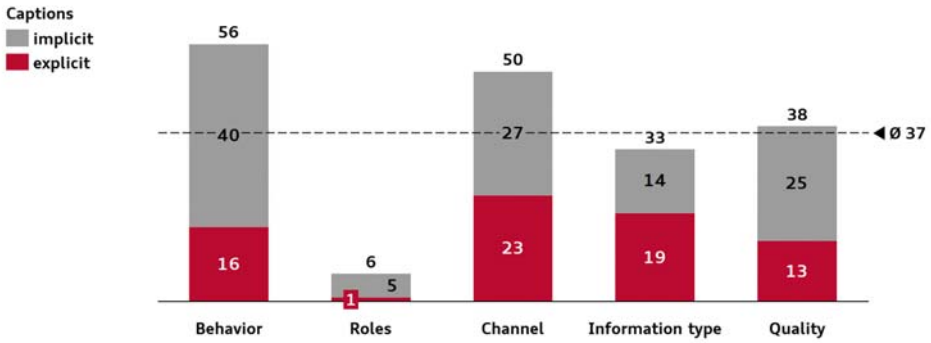

Figure 4: Relevant articles for communication shown per communication dimension. The articles with an explicit focus are in red.

Findings concerning production ramp-up management

As the second search round focused on communications in supplier relationships, many of the identified articles within this round did not contain ramp-up management content. Therefore, there are only six main articles with a focus on the integrated aspect of communication in ramp-up management. The results show that only two articles focus explicitly on communications during ramp-up (Figure 5). Furthermore, only two articles, Bußwolder et al. (2016) and Kremsmayr et al. (2016), distinguish between different phases within the production ramp-up.

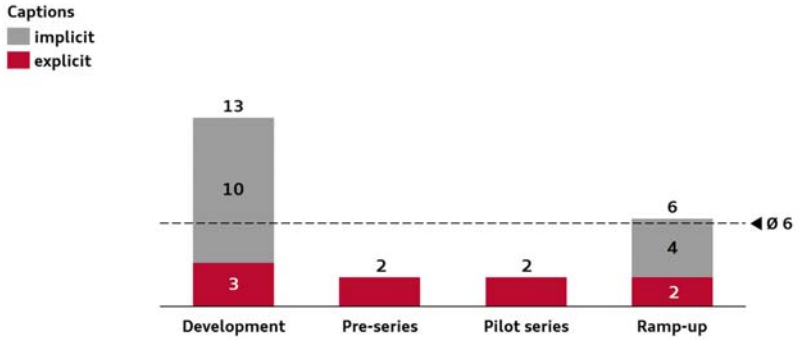

Figure 5: Relevant articles for ramp-up management shown in a timely manner. The articles with an explicit focus are in red.

Results of six key articles on supplier communications in ramp-up management

Based on the analysis in the last section, a first finding is that there is a great research gap with respect to communications in ramp-up management. Only six articles address supplier communications in ramp-up management, and five of those papers are from the intra-company perspective. Only Thiebus et al. (2006) examine knowledge management in the automotive supply chain. Thus, a research gap could be identified to analyze communications in the buyer-supplier relationship since the articles are case-based or conceptual and a statistical validation is missing. Table 3 provides an overview of the key articles, and the following section will analyze these articles in more detail.

Table 3: Overview of key articles on supplier communications in ramp-up management

Author	Title	Industry	Method	Supplier mgmt	Ramp-up mgmt	Communication
Bauer et al. (2014)	Concept of a Failures Management Assistance System for the Reaction on Unforeseeable Events during the Ramp-Up	automotive	concept	intra-company	implicit	information and communication flow/ transparency
Bußwolder et al. (2016)	Classification of Company-specific Influence Factors as Part of a Knowledge Management System for Ramp-up Projects	automotive	survey	intra-company	explicit	knowledge management/ transparency
Fjällström et al. (2007)	Differences Concerning Information when Handling Predictable and Unpredictable Events in Production Systems	automotive	case study	intra-company	implicit	types of information
Kremsmayr et al. (2016)	On the Application of Agility Principles in Ramp-up Management: Approaching the Challenges in the High-End Powder Metallurgy Industry	powder metallurgy	concept	intra-company	explicit	transparency
Surbier et al. (2010)	Interface Modeling and Analysis during Production Ramp-up	electronic	case study	intra-company	implicit	information exchange/ information quality/ information flow
Thiebus et al. (2006)	Knowledge Management for Ramp-up in the Automotive Industry	automotive	concept	supply chain	implicit	knowledge management

Bauer et al. (2014) developed a failure management assistance system to handle unpredictable events during ramp-up. Therefore, information and communication flow and transparency are two major factors for the success of the system. Bußwolder et al. (2016) only mentioned that knowledge management and transparency are very important for the success of a ramp-up project, but they give no details of how to communicate. In contrast, Fjällström et al. (2007) identified the information types required for successful production ramp-up and compared the preferred methods of information perception and information strategies. Kremsmayr et al. (2016) noted that a successful ramp-up requires the highest transparency concerning process maturity. Like Bußwolder et al. (2016) they give no further details on communication. The purpose of Surbier et al. (2010) is to design diagnosis tools to analyze and characterize the information exchange at the interface between project actors. Thiebus et al. (2006) described a new approach based on the cycle of organizational learning to improve ramp-up performance in the automotive industry. The analysis revealed that present research addresses supplier communication in ramp-up management in a rather generic and fragmented way with a low level of detail. This is in contrast to being guided from a theoretically substantiated perspective that also takes into consideration the fact that most articles only mentioned communication. Thus, there are only a few starting points about supplier communication in ramp-up management (Figure 6).

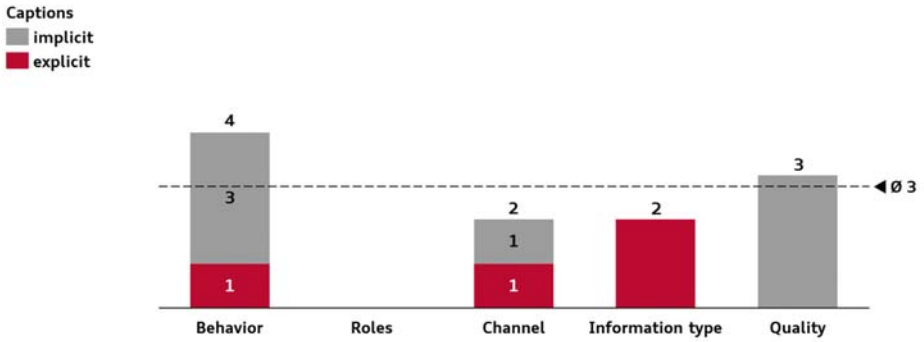

Figure 6: Key articles for supplier communications in ramp-up management shown per communication dimension. The articles with an explicit focus are in red.

In addition, an analysis of the influencing factors and sources of irritation (noise) on communication was conducted within the key articles. Table 4 provides an overview of the identified content. Two of the major influencing factors and sources of irritation are increasing (product and process) complexity and shorter product life cycles (Bauer et al., 2014; Bußwolder et al., 2016; Kremsmayr et al., 2016; Thiebus et al., 2006). Other sources of irritation are late engineering changes (Bauer et al., 2014; Fjällström et al., 2007; Surbier et al., 2010) and inexperienced or limited trained staff (Bauer et al., 2014; Fjällström et al., 2007).

Table 4: Influencing factors and sources of irritation of supplier relationship, communication and ramp-up management reviewed in the six key articles.

Author	Influencing factors and sources of irritation
Bauer et al. (2014)	**increasing product and process complexities**, **less time-to-market**, highest quality requirements, a wide range of failures, poor standardization levels, **inexperienced workers**, **multidisciplinary collaboration with changing**, unclear responsibilities, complex internal information flows
Bußwolder et al. (2016)	**shorter life cycles**, higher rates of innovation, **increasing number of variants**, persistent globalization, increase of dynamic market trends, competition, **increasing product complexity**
Fjällström et al. (2007)	**late engineering changes**, late or defect deliveries from suppliers, insufficient test and verification of the product and its production system**, limited training for the personnel**
Kremsmayr et al. (2016)	growing requests for specialized products**, shorter product life cycles**, accelerated innovation times, tighter development timelines, **growing production complexity**, demand uncertainty, resource availability, competitive pressure
Surbier et al. (2010)	**technical product changes**, personality differences, cultural differences, language barriers, organizational barriers, physical barriers
Thiebus et al. (2006)	**increasing product diversification**, **decreasing product life cycle times**, permanent need for cost reduction, increasing quality requirements, **increasing complexity in products and processes**, increasing demand for product innovations

Discussion

The purpose of this contribution was to answer the guiding research question that asked about the status quo of supplier communications in ramp-up management. This paper analyzed 86 relevant papers. On this basis, descriptive findings about the development of the literature over time, the distribution on application fields and author origins were made. Content analysis focused on the communication process and its categories. Based on the analysis framework (see Figure 1), the core findings about supplier communication in ramp-up management could be summarized in two steps.

Referring to the ramp-up management, hardly any contributions distinguish separate sub-phases within the ramp-up. Only two papers, namely, Bußwolder et al. (2016) and Kremsmayr et al. (2016), analyze communication in ramp-up management in the three phases of (A) pre-series, (B) pilot series and (C) ramp-up. Until now, ramp-up management was only analyzed in a holistic way, but an in-depth analysis of supplier communications during the three ramp-up management phases is missing.

Referring to the communication process between buyers and suppliers, several findings were derived. The first communication dimension, behavior, is generally characterized through trust and commitment that influence successful relational exchanges (Abdullah and Musa, 2014; Crotts and Aziz, 1998; Large, 2005). Communication behavior is also described as the willingness to share information (Kim and Chai, 2017; Wu et al., 2014). Nevertheless, there is no transfer to the ramp-up management. Only Fjällström et al. (2007) examines human behavior for unpredictable and predictable events during ramp-up. They subdivide behavior into skill-based, rule-based and knowledge-based behaviors.

The second dimension, roles, is underrepresented. Even if there is a role theory described by Andersen et al. (2009) and Dong et al. (2016) that generally define the role between buyers and suppliers through their shared expectations, an explicit analysis of their communications during the ramp-up process could not be found. Additionally, the literature hardly distinguishes institutional communications in the buyer-supplier relationship and individual communications, e.g., between the procurement manager and the product manager. The macro and micro levels of the methodological individualism are hardly connected.

The third dimension of communication, channels, includes addresses, as some examples for different channels are provided by Cai et al. (2010) and Oosterhuis et al. (2013), and is classified by media richness (Prahinski and Benton, 2004; Thomas, 2013). During ramp-up, Surbier et al. (2010) analyzed only face-to-face communication, which is ranked as the richest medium for communication.
Fourth, information type is a relatively explicitly researched communication dimension during ramp-up. Fjällström et al. (2007) classified the information available in the problem information, domain information and problem-solving information. In contrast, Surbier et al. (2010) categorized information in three degrees of information structure as 1) structured information, 2) semi-structured information and 3) non-structured information.
Fifth, a few suggestions about the quality of communication are made by Li and Lin (2006), Marinagi et al. (2015) and Zhou et al. (2014). They well characterized communication quality as, the situation when accurate, reliable and relevant information is received in time. Surprisingly, there is no explicit consideration of communication quality during ramp-up.
Finally, sixth, a list of relevant influencing factors and sources of irritation has been derived from the six key articles. Of these, complexity (in products and processes) and shorter development time (Bauer et al., 2014; Bußwolder et al., 2016; Kremsmayr et al., 2016; Thiebus et al., 2006) are most important influential factors of supplier communications during ramp-up. Late engineering changes (Bauer et al., 2014; Fjällström et al., 2007; Surbier et al., 2014) and inexperienced or limited trained staff (Bauer et al., 2014; Fjällström et al., 2007) are sources of irritation.
Generally, it seems as if the topic has been researched only in a very generic way. Statements about supplier communication refer to ramp-up management, but little is operationalized for this special case. A few isolated starting points exist for the fourth and sixth topics, information type and influencing factors and sources of irritation. Nevertheless, in summation, the discovered knowledge modules build no integrated management model for supplier communications during ramp-up.

Conclusion

The reported literature review indicates that communication is an important component of the success of ramp-up. However, until now, it lacks sufficient theoretical grounding. A total of 86 articles have been identified, but surprisingly only six of them explicitly address the topic. This is also a clear limitation of this research. Even if the topic is addressed, it is discussed without considering a holistic communication approach/ model of production ramp-up. Furthermore, there is no specification or detailing of the communication dimensions for the specific phenomenon of production ramp-up. In sum, there is no full picture of the topic of supplier communications during production ramp-up in the literature. Therefore, this article concludes that there is a wide range of future research gaps.

- There are only isolated starting points of concepts for supplier communication in ramp-up management (see section findings, description Figure 4 and explicit Figure 6).
- Changes in the communication process in the three phases of ramp-up must be individually detailed and described (see section findings in combination with description Figure 5).
- There is a need to research communication during ramp-up within the dyad of buyers and suppliers (see section findings, description Table 3).
- There is no statistical validation of the hypothesis proposed by the conceptual research by Bauer et al. (2014), Kremsmayr et al. (2016) or Thiebus et al. (2006) (see section findings, description Table 3).

The future will bring a change in buyer-supplier communication with respect to the communication channel (modern information and communication systems) and the amount of exchanged data. The future improvements in the communication capabilities could be used to improve ramp-up if managed properly. Communication has a high potential to increase

production quality and reduce production time and costs. Therefore, there is a need for a communication-ramp-up management model to analyze the details of the communication process during ramp-up.

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Evaluation of Supplier Innovation

Avoiding the dismissal of "good" supplier innovation due to customers' "bad" evaluation procedure

Janina Goldberg

Department of Technology Management and Supply, University of Twente, The Netherlands, 7500 AE Enschede, j.m.goldberg-1@utwente.nl, phone: +491724449901

Holger Schiele

Department of Technology Management and Supply, University of Twente, The Netherlands, 7500 AE Enschede, h.schiele@utwente.nl, phone: +31 53 489 5615

Abstract

In this paper, a benchmarking analysis is conducted to show best practices for the evaluation and selection of supplier innovations. The results show that the most popular evaluation method is gut feeling and that all of the case companies analyze only the quality of the innovation, neglecting to evaluate the supplier proposing the innovation. To further develop these results, a World Café workshop was held. Consequently, two operationally usable checklists were developed to evaluate the characteristics of the external innovation and the qualities of the innovative supplier. Both checklists can be combined into one evaluation scoring model for supplier innovations.

Key words

Supplier innovation evaluation; innovation assessment

Introduction

Supplier involvement in new product development (NPD) is one of the most common reasons proposed to explain the performance in NPD projects (Dekkers, Chang and Kreutzfeldt, 2013). Roberts' panel study from 2001 shows that in the early 1990s, only 22% of the top R&D-intensive firms surveyed heavily relied on external partners for innovation; however, he also shows this share had grown to 85% by the end of that decade (Roberts, 2001). For example, in the automotive industry, most new patents are registered by suppliers (Schiele, Calvi and Gibbert, 2012). Simultaneously, companies benefit the most (e.g., from a financial perspective) from breakthrough or radical innovations (O'Connor, Ravichandran and Robeson, 2008). Early supplier integration (ESI) in the NPD process is used at buying companies to obtain a competitive advantage (Bidault, Despres and Butler, 1998; Johnsen, 2009; McIvor and Humphreys, 2004). ESI can be defined as the extent to which a buying organization shares

responsibility with a supplying organization to develop and design new products or components (Hoegl and Wagner, 2005). Several studies show that ESI increases the innovative strength of a buying company and the capability of innovation project execution (Fitjar and Rodríguez-Pose, 2013; Koufteros, Cheng and Lai, 2007; Song and Thieme, 2009; Un, Cuervo-Cazurra and Asakawa, 2010). On the other hand, it is also possible that supplier collaboration in the NPD process shows no certain performance improvement (e.g., no reduced time-to-market) (Eisenhardt and Tabrizi, 1995; Hartley, Zirger and Kamath, 1997; Swink, 1999) or even results in a negative impact on the business of the buying company (Littler, Leverick and Wilson, 1993). Furthermore, there are some reports that show deficits on the supplier side or even project obstruction when unsuitable suppliers were selected (Flynn, Flynn, Amundson and Schroeder, 2000; Hartley et al., 1997; Petroni and Panciroli, 2002; Primo and Amundson, 2002; Zsidisin and Smith, 2005). Buying companies are then disappointed by what some authors call supplier obstructionism (Flynn et al., 2000; Hartley et al., 1997; Hibbard, Kumar and Stern, 2001; Petroni and Panciroli, 2002; Primo and Amundson, 2002; Zsidisin and Smith, 2005). Concurrently buying companies seem to have only a limited understanding of how to include suppliers in NPD (Lakemond, Berggren and Weele, 2006).

However, ESI in NPD always implies a high level of dependence on the supplier, which may increase the risks for the buying company. Thus, for organizations, it is important to choose both the "right" innovations (which become in the future commercially successful) from the "right" supplier (which offers proper project execution) to obtain a competitive advantage and ensure the survival of companies.

Although most innovations are provided by suppliers, typical innovation assessment models, both in theory and in practice, tend to focus their analysis on only scoring the quality and the potential of the innovation considered (Cooper and Kleinschmidt, 1987b; Figueroa and Conceição, 2000; García-Álvarez, 2015; Hartschen, Scherer and Brügger, 2009; M. Heesen, 2009; Salerno, Gomes, Silva, Bagno and Freitas, 2015). However, the most promising innovation will not succeed if the supplier proposing it cannot perform proper project execution or cannot further develop the innovation. Based on these facts, the research question of this paper is as follows: How can the selection of the wrong innovations, which may fail due to the deficits of the supplier, be avoided and how can the selection of the promising supplier innovations be enhanced? Since the literature review found no model or process that explicitly focuses on supplier innovations or assesses the innovative supplier, the goal of this study is to develop such a scoring model, which considers both the evaluation of the innovation characteristics and the evaluation of the supplier. By developing such a model the users within a company receive a tool to evaluate supplier innovations and a decision tool to select the most promising ones. Ultimately, this model has the function to raise the number of successfully implemented innovations.

The following theory section presents a short overview and provides a definition of NPD and innovation evaluation as part of the innovation management process and of ESI as well as the role of the supplier in the NPD process. The subsequent section presents the method and analysis used in this study. To assess the best practice for the evaluation of supplier innovations, a benchmarking analysis with 16 leading German companies was conducted. In general, the results show that most companies focus on analyzing innovations but neglect to analyze the suppliers providing the innovations. To discuss the benchmarking results and to develop an innovation evaluation tool that includes the supplier evaluation, a second method was adopted – a World Café workshop. As a first outcome, two operationally usable checklists to evaluate, on the one hand, an external innovation and, on the other hand, an innovative supplier were developed. The second outcome is the combinability of the two checklists into one scoring

model that evaluates a supplier innovation from two sides – the innovation criteria side and the supplier side. Additionally, the results reveal two innovation-supplier constellations, which, to date, have been blind spots. How should "bad" innovations from "good" suppliers or "good" innovations from "bad" suppliers be treated? This paper ends with a discussion and conclusion section showing further considerations and complementary ideas.

Theory

Innovation evaluation as part of the new product development process

Innovations are defined as "new solutions" in products, technology, processes and marketing, representing one way through which organizations gain competitive advantage (O'Reilly and Tushman, 1997). To develop and handle the different kinds of innovations within a company, several NPD and innovation management approaches are known. Typically, sequential, multi-step processes are used to decide on and implement innovations. For instance, Lynn et al. describe a conventional NPD process as occurring through idea generation, idea screening, innovation development, testing, and new product launch (Lynn, Morone and Paulson, 1996; Williams and McGuire, 2010). Effective management of the NPD process from the product idea to launch is crucial to ensure that organizations survive and prosper (Cooper and Kleinschmidt, 1987b). However, for companies, it is not easy to choose and promote promising innovations for several reasons. One reason is the blocking and defensive attitude that can be observed in the individuals of the organization itself. This attitude especially occurs in the face of radical innovations that indicate change or that even cannibalize the current business (Chandy and Tellis, 1998, 2000; O'Connor et al., 2008).

Following Cooper, there are two main challenges in the innovation management process: first, the selection of the strongest innovation ideas and, second, an effective process management (Cooper and Kleinschmidt, 1987b). To ensure the best selection, clustering and evaluating the different innovation ideas is essential. For innovations, the literature describes several clustering approaches. They usually become clustered according to their characteristics, e.g., according to the novelty level (radical/disruptive/incremental), the subject area (product innovation/process innovation/etc.), or the complexity or conflict level (García-Álvarez, 2015; Hartschen et al., 2009; M. Heesen, 2009; Tang, 2006; Tavassoli and Karlsson, 2015). Following Sabisch, evaluation is defined as the detection and assessment of the degree of fulfillment of the given objectives for a particular evaluation object (Sabisch, 1991). The goal of innovation evaluation is to compare different alternatives to prepare the selection decision (Sabisch, 1991; Venter, 2006). It is important to select the innovation project wisely because organizational resources in the form of human resources, capital and time are usually limited and the overall goal is to obtain the maximum innovation success (Granig, 2008). Cooper and Kleinschmidt define three dimensions to measure new product performance: financial, market impact and the so-called opportunity window (if the new product opens a new business field or opportunity) (Cooper and Kleinschmidt, 1987a; García, Sanzo and Trespalacios, 2008). More recent studies distinguish between two basic performance dimensions: internal (or project) and external (or market) success (Alegre, Lapiedra and Chiva, 2006; Blindenbach-Driessen, Van Dalen and Van Den Ende, 2005; García et al., 2008; Tatikonda and Montoya-Weiss, 2001; Valle and Avella, 2003). On the one hand, project success measures the effectiveness of the NPD process (project time, development costs, or the degree of product superiority); on the other hand, market success involves the commercial result of the new product (financial performance, the degree of acceptance and satisfaction perceived by consumers) (Blindenbach-Driessen et al., 2005; García et al., 2008; Valle and Avella, 2003). There are several methods to measure the

abovementioned dimensions, e.g., cost-benefit analysis (which is used to create a ranking between different alternatives) (Gleich, Munck and Tkotz, 2016), the PROMETHEE method (Preference Ranking Organization Method for Enrichment Evaluations, which is an outranking method for a finite set of alternative actions or, in our case, innovations, to be ranked and selected among criteria that are often conflicting) (Behzadian, Kazemzadeh, Albadvi and Aghdasi, 2010; Bin, Azevedo, Duarte, Salles-Filho and Massaguer, 2015) or investment calculation (a procedure for assessing investment projects with regard to quantifiable corporate goals; it may be an assessment of one single innovation object or a comparison of different investment alternatives with the same purpose) (B. Heesen, 2010). The execution of the various evaluation methods prepares a decision by matching and comparing the scores of the innovation project with company goals (Pleschak and Sabisch, 1996). After the evaluation and selection of the innovations, the next process step is project execution and the innovation implementation or innovation launch.

Supplier involvement in the new product development process

Cooper defines effective process management as the second challenge in the innovation management process (after the first challenge, the selection of the strongest innovation ideas) (Cooper and Kleinschmidt, 1987b). Because, at present, buying companies receive most innovations from suppliers (Dekkers et al., 2013), logically, in process management and innovation project execution, cooperation with the supplier is also a crucial aspect (Schiele, 2010). The demand for an ever shorter time-to-market and the enormous technological knowledge that is needed to develop new products force firms to increasingly rely on supplier cooperation (Azadegan, 2011; Hong, Doll, Revilla and Nahm, 2011; Koufteros, Rawski and Rupak, 2010; Thomas, Fugate and Koukova, 2011; Stephan M Wagner, Rau and Lindemann, 2010; Stephan M. Wagner, 2012). With the goal of obtaining a greater competitive advantage through supplier cooperation, many companies are adopting ESI, which is defined as vertical cooperation where companies involve suppliers at an early stage in the NPD process (Bidault et al., 1998; Hoegl and Wagner, 2005). The contribution of a supplier (e.g., through skills, and talents) can constitute a significant advantage in the product development process (He, Keung Lai, Sun and Chen, 2014). Particularly in terms of increasing the innovative strength of a buying company and the capability of innovation project execution, ESI plays a key role (Brem and Tidd, 2012; Fitjar and Rodríguez-Pose, 2013; Koufteros et al., 2007; Song and Thieme, 2009; Un et al., 2010). Several studies show that supplier cooperation in the NPD process may provide enormous benefits, e.g., a shorter time-to-market (Ragatz, Handfield and Petersen, 2002), higher product quality or lower project costs and time (Primo and Amundson, 2002). Conversely, the implication is that buying companies must compete for suppliers with superior innovation power or suppliers with exclusive access to radical innovations. Social exchange theory precisely describes this situation: It posits that actors first evaluate the attractiveness of a potential partner, if possible, compare expectations with the outcomes of the relationship and – importantly – then compare one partner with potential alternatives (Lambe, Wittmann and Spekman, 2001). Additionally, the fact that a large majority of radical innovations come from a minority of firms (O'Connor et al., 2008; Sorescu, Chandy and Prabhu, 2003) leads to an intensification in the competition for the best suppliers and thus to growing supplier dependence. This evolution clearly indicates that if companies want to gain access to the most promising innovations and achieve superior project execution and a privileged relationship (Petersen, Handfield and Ragatz, 2005), then they must compete against other buying companies to receive preferred customer status from the innovative supplier (Schiele, 2012). According to Hüttinger et al., preferred customer status is defined as follows: It influences the behavioral intentions of the supplier to the extent that the supplier awards selected customers with more favorable treatment than others (Hüttinger, Schiele and Veldman, 2012).

This high level of supplier dependence, caused by ESI in the NPD process, carries great risks for buying companies. Some suppliers, for instance, do not always collaborate in the manner expected. Furthermore, some organizations seem to have only a limited understanding of how to include suppliers in NPD (Lakemond et al., 2006). Some studies show the possibility that ESI will lead to no certain performance improvement (Eisenhardt and Tabrizi, 1995; Hartley et al., 1997; Swink, 1999) or that it even results in a negative impact on the business of the buying company (Littler et al., 1993). Additionally, there are many reports that show the incompetence of suppliers in project execution and even project obstruction if unsuitable suppliers were selected (Flynn et al., 2000; Hartley et al., 1997; Petroni and Panciroli, 2002; Primo and Amundson, 2002; Zsidisin and Smith, 2005). The underlying concept in these studies is called "supplier obstructionism", which is defined as the measurement of the damage to NPD projects due to dependence on uncooperative suppliers (Flynn et al., 2000; Hartley et al., 1997; Hibbard et al., 2001; Petroni and Panciroli, 2002; Primo and Amundson, 2002; Zsidisin and Smith, 2005). The worst-case scenario for a buying company would be being dependent on the resources of the supplier for its innovation process while being denied access to these resources (Schiele and Vos, 2015). The description of this phenomenon clearly notes that not only "bad" innovations with bad evaluation scores fail but also a certain number of "good" innovations fail due to the bad performance of the supplier. Since the supplier plays such a key role in the NPD process, it is very surprising that no innovation evaluation tool includes a supplier assessment. Moreover, no innovation evaluation method that explicitly focuses on the characteristics and specialties of supplier innovations was found. The lack of such a method is precisely the research gap that this study aims to close by developing a scoring model that evaluates an innovation from both sides – the innovation characteristics side and the supplier side.

Research Methodology

To evaluate the existing best practices in the innovation evaluation of supplier innovations and to further develop the results, two research methodologies were adopted. Initially, a benchmarking analysis was conducted. Benchmarking is defined as the search for best practices in a certain field or in relation to a specific topic, with the goal of achieving superior performance by implementing the best practice (Camp, 1989). Three types of benchmarking can be distinguished: process benchmarking (which this paper applies), product or service benchmarking and strategic benchmarking (Drew, 1997). The aim of this benchmarking study was to identify the best practice for clustering, evaluating and selecting supplier innovations. Ultimately, 16 companies participated in the benchmarking (73 companies were invited – 22% accepted the invitation). The participants were experts from various leading companies located in Germany (14 were founded in Germany, and 2 were companies with a German branch that were founded abroad). The goal was to devise a participant setup that was as diverse as possible. Therefore, companies with different sizes and from eight business sectors were selected (details are shown in figure 1). Eight of the companies had fewer than 10,000 employees; the other eight firms had more. The individuals representing the companies were either purchasing managers, innovation managers or NPD process managers.

Company	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
Industry (all companies are located in Germany)	mechanical engineering and production facility construction					tooling	electronics				construction			automation technology	pharmaceutical industry	aviation		software, communication and IT		science and technology	chemistry and material science	consulting		
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Employees																								
< 10,000	x		x			x		x		x	x	x	x								x	x	x	x
> 10,000		x		x	x		x		x					x	x	x	x	x	x	x				
Turnover 2015/2016																								
< 10 billion €	x	x	x	x	x							x		x	x	x			x		x			
> 10 billion €							x		x				x				x	x		x				
not published						x		x		x	x											x	x	x
Benchmarking participant																								
1 participant	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x						
World Café participant																								
1 participant			x				x										x		x	x	x	x	x	x
2 participants		x				x												x						

Figure 1: Case companies from the benchmarking and the participants in the World Café

The second method, the World Café, was created by Brown and Isaacs (Brown and Isaacs, 2005) and can be regarded as a specialized form of the conventional focus group approach (Brennan and Ritch, 2010). Following Schieffer et al., the key purpose of a World Café is to work and think within a group and hence innovate collaboratively (Schieffer, Isaacs and Gyllenpalm, 2004). It is a user-friendly method with the following characteristics: The participants divide themselves into small groups that come together at different tables. At each desk, one particular aspect of the research problem is discussed with the help of a moderator who hosts the debate (Hüttinger, Schiele and Schröer, 2014). After a predefined period of time (usually 20-45 minutes), the participants are requested to change tables. They can freely choose the table for the next round but may not return to any table at which they had already participated. Consequently, each discussion round brings together a new group in a new constellation. At the beginning of each round, the moderator shows and summarizes the previous discussion points. This process is repeated until each participant has contributed to every discussion topic (Hüttinger et al., 2014). At the end, each moderator summarizes the results of his table and presents them to the plenum. Frequently, the final step is an evaluation round in which the participants walk around and review the lists of results on each table. They rate the aspects on each table with the help of "stickers". In doing so, a ranking of the aspects emerges on each table. The more "stickers" that one aspect receives, the more important it is in the eyes of the participants.

The superordinate topic of this World Café workshop was the "evaluation and execution of supplier innovations at buying companies". To investigate this subject, four tables were executed; each table addressed one of the following subtopics: "innovation clustering and evaluation, with a focus on the innovation (1)", "innovation clustering and evaluation, with a focus on the supplier (2)", "innovation control, with a focus on the success measurement of the innovation and the process" and "innovation promotors". As the scope of this paper is the innovation evaluation of supplier innovations, only the results of tables 1 and 2 are shown and discussed. Altogether, 15 participants from 12 companies took part (three companies with two experts each participated) – seven of them had already participated on behalf of their companies in the benchmarking, and eight were newly recruited to complete and balance the sample. This combination was chosen to have, on the one hand, participants who were involved in the creation of the base data and, on the other hand, participants who could give new stimuli. Once again, the new participants were selected according to their expertise in the areas of innovation management, NPD and purchasing. Moreover, it was very important to assemble a circle of participants who were as diverse as possible. The participating companies of the World Café are shown in figure 1.

Analysis

All benchmarking participants were interviewed using a detailed questionnaire containing two different subcategories: innovation clustering (1) and innovation evaluation and selection (2). The benchmarking results are summarized in figure 2.

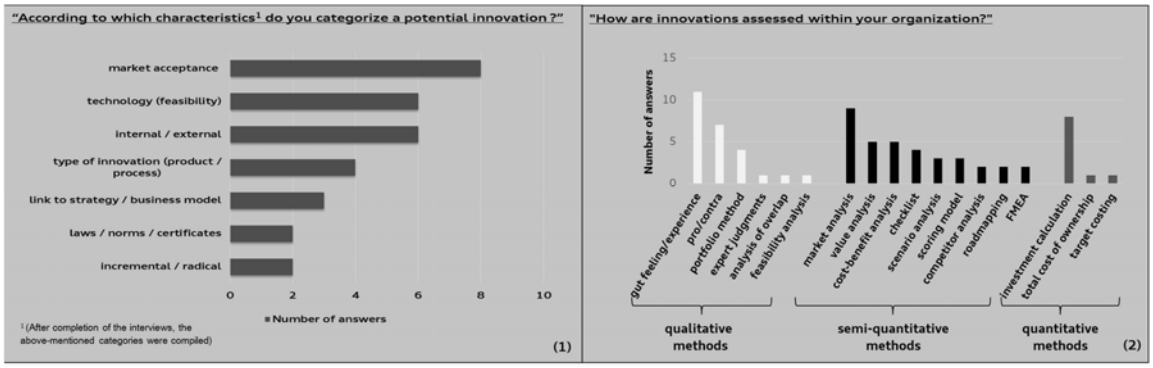
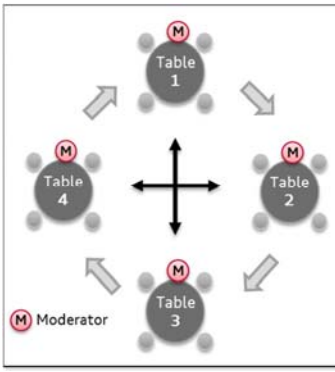


Figure 2: Results of the benchmarking analysis

(1) *Innovation clustering:* A total of 58% of the case companies cluster emerging innovation in different categories. The three most commonly used clustering categories are the expected market and customer acceptance, the technology maturity level and the expected feasibility and in internal and external innovations.

(2) *Innovation evaluation and selection:* In the next step, the participants were asked if and how the clustered innovations become evaluated and selected (most companies mentioned several methods). Only 25% of the case companies use different evaluation methods for internal and external innovations. A total of 38% of the used methods are qualitative, 48% of the methods are semi-quantitative, and 14% are quantitative. The most commonly used evaluation method is gut feeling and experience (69% of the case companies apply this method). Market analysis is the second most commonly used evaluation tool (56% of the participants use this method). In addition, the third most popular evaluation method is investment calculation (50% of the case companies apply this method).

Analyzing the results of the benchmarking revealed that most case companies base their innovation evaluations on gut feeling or experience. This finding supports the assumption that there is no easily applicable evaluation tool for innovations available. The results also show that none of the case companies assesses the supplier from which the innovation is distributed. This practice experience also confirms the findings from the literature review. To discuss these insights from the benchmarking analysis and to further develop them and create easy-to-use evaluation checklists and a scoring model for the evaluation of supplier innovation, the World Café method was used as a second technique.



World Café 1

Round	*Time*
1	30 min
2	15 min
3	10 min
4	10 min

Rating: All flipcharts will be shown and presented to the participants. The participants perform the evaluation with the help of stickers (30min). 20 stickers per expert (5 stickers per topic)

World Café 2

Round	*Time*
1	40 min
2	20 min
3	10 min
4	10 min

Summary of results
Each moderator summarizes the results of his table (5 min each = 20 min)

Figure 3: Setup of the World Café workshop

In this study the standard World Café method was changed; two small World Cafés were combined into one workshop. In World Café 1, each moderator at each table showed part of the consolidated results of the benchmarking referring to the topic of his table. In the following four short World Café rounds, the participants discussed the benchmarking findings and had the chance to add new aspects and arguments. At the end of World Café 1, the evaluation round occurred. Each of the 15 participants received 20 stickers (5 for each table) to rate the aspects that were the most important from their perspective. Because, on each table, 75 stickers were used, the highest possible rating for a single aspect was a score of 75 stickers (if one aspect received all stickers). After analyzing the sticker rating, the moderators took the most highly rated aspects to work on in World Café 2. In this World Café, the participants were asked to further detail the main aspects and to create an operational model or tool to use in operational innovation management. The structure of the entire World Café workshop is shown in figure 3.

In World Café 1, initially, all participants received from their table moderators the aggregated result as an input for the following four working rounds. At tables 1 and 2, they received the results of the clustering and evaluation methods used from the benchmarking (figure 2).

(1) At table 1, "innovation clustering and evaluation, with a focus on innovation", 25 criteria and methods were developed in the four discussion rounds in World Café 1. Through the sticker rating procedure, the five criteria with the highest relevance, according to the participants' opinions, were chosen and made eligible for World Café 2. The ranking was calculated according to the number of stickers that an aspect received. The following five criteria received the highest scores: market potential (rank 1: 18% of the 75 stickers at table 1); influence on the existing business model (rank 2: 12%); market/customer acceptance (rank 3: 9%); cost-benefit analysis (rank 4: 9%); and proof of concept (rank 5: 8%). The three criteria "market potential", "market / customer acceptance" and "proof of concept" also ranked in the top 5 in the benchmarking scores.
(2) At table 2, "innovation clustering and evaluation, with a focus on the supplier", 18 possible criteria to rate the innovating supplier were generated. The following five criteria received the highest scores through the "sticker" rating: employees at the supplier (rank 1: 24% of the 75 stickers at table 2); creative potential (rank 2: 19%); endurance (rank 3: 17%); exclusivity (rank 4: 9%); and other customers of the supplier (rank 5: 9%). Neither these nor other criteria were mentioned in the benchmarking to assess the innovating supplier.

The task in World Café 2 was to focus on the top five rated aspects from World Café 1, to further detail them by forming sub-criteria and to create operational models that can be used to evaluate supplier innovations. The participants at table 1 worked on the five main aspects for innovation evaluation, with a focus on innovation characteristics: "market potential", "influence on the existing business model", "market/customer acceptance", "cost-benefit analysis" and "proof of concept". To make a potential evaluation following these criteria more user-friendly, over the four working rounds of World Café 2, the participants created a checklist and formulated and clarified examples for weak or strong scores for each sub-criterion (all results are summarized in figure 4). The criterion "market potential", for example, evaluates the "market situation" (which forecasts whether the innovation only secures the current market share or whether it even creates a new monopoly) and the level of "differentiation" from the competition. The details for the other four criteria of table 1 are shown in figure 4.

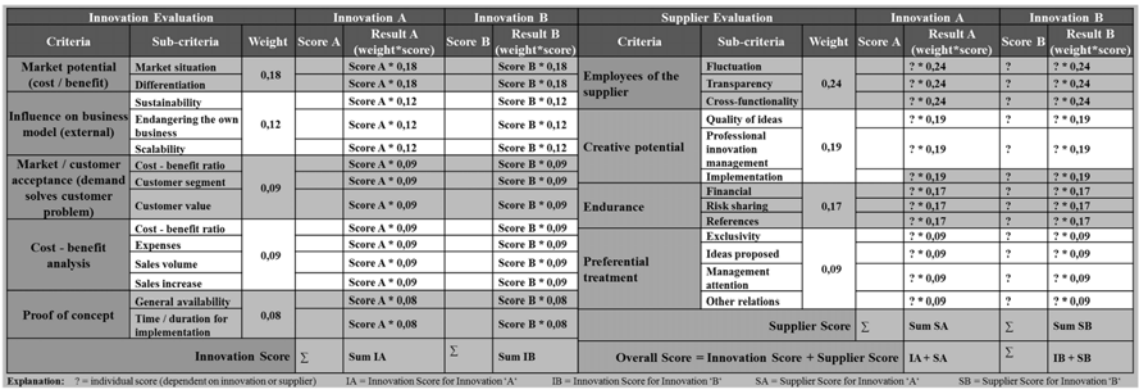
Criteria	Sub-criteria	Example of Weak Score (1)	Example of Strong Score (10)
Market potential (cost / benefit)	Market situation	Secures market position (market share constant)	Creates market monopoly (sole provider)
	Differentiation	No differentiation from competition	Innovation creates USP (unique selling point / proposition)
Influence on business model (external)	Sustainability	Business model not sustainable (short-term)	Business model sustainable (long-term lead)
	Endangering the own business	Innovation has potential to destroy the (current) business	Innovation does not endanger the (current) business
	Scalability	Not scalable	Easily scalable
Market / customer acceptance (demand solves customer problem)	Cost-benefit	Cost-benefit ratio > 2 (customer)	Cost-benefit ratio> 10 (customer)
	Customer segment	Only interesting to existing customers	Opens up new customer groups
	Customer value	Does not add value to the customer	Solves central problem of all customers
Cost-benefit analysis	Cost - benefit ratio	Cost – benefit ratio > 2 (enterprise)	Cost-benefit ratio > 10 (enterprise)
	Expenses	High long-term investment needed	Little investment needed, short payback
	Sales volume	Limited influence on sales	Considerable sales volume (>30% of current)
	Sales increase	No increase	Multiplication of current sales volume over the next years
Proof of concept	General availability	No MVP (minimum viable product) available	Functioning MVP (minimum viable product) + Lessions Learned
	Time / duration for implementation	Long term (2-3 years)	Short term (3 months)

Figure 4: Criteria for innovation evaluation (results from table 1)

At table 2, the participants in World Café 2 also worked on the five aspects that achieved the highest scores in round one: “employees at the supplier”, “creative potential”, “endurance”, “exclusivity” and “other customers of the supplier”. In the four working rounds, they merged two criteria, “exclusivity” and “other customers of the supplier”, into one new aspect called “preferential treatment”. Apart from this action, they also formed sub-criteria and examples for weak and strong scorings, which was precisely the same procedure performed at table 1. The first main criterion, “employees at the supplier”, was sub-divided into “fluctuation” (which assesses the turnover rate of employees), “transparency” (which shows the level of openness regarding the team structure and the qualification of team members) and “cross-functionality” (the level of diversity within the supplier team). The second main criterion, “creative potential”, assesses the overall “quality of ideas” of the supplier, the level of “professionalism within the innovation management” of the supplier and the number of implemented innovations. The main criterion, “endurance”, indicates whether the supplier stands on a solid “financial” basis, performs a fair “risk sharing” and can provide good “references” from other industries or customers. The fourth main criterion, “preferential treatment”, reflects whether the buying company receives “exclusivity”; moreover, it shows whether the supplier proposes ideas to the evaluating company first or not. Furthermore, it assesses the degree of “management attention” on the supplier side and the number of “other relations” between the supplier and the evaluating company. All results for table 2 are shown in figure 5.

Criteria	Sub-criteria	Example of Weak Score (1)	Example of Strong Score (10)
Employees of the supplier	Fluctuation	Constant employee turnover	Less then 2% fluctuation
	Transparency	No visibility of the personnel of the supplier	Entire team with CVs is known and is the “A-team” of the supplier
	Cross-functionality	Only sales personnel visible	On the supplier team multiple functions collaborate well with each other
Creative potential	Quality of ideas	Single idea, narrow view, no understanding of embededdness	Several business model-changing ideas embedded in a global view, understanding the market
	Professionalism within the innovation management	Spontaneous idea management only	Well documented professional innovation management (process, KPI, gates)
	Implementation	Few innovations actually implemented, late cessation of unsuccessful projects	High ratio of ideas presented and implemented, quick abort mechanism
Endurance	Financial	Unstable financial condition	Good solvency - equity ratio available
	Risk sharing	Wants to transfer full risk to customer	Willing to share risks (e.g., carries development costs armortized through future sales)
	References	No references	Many good references in the industry and part of the network
Preferential treatment	Exclusivity	Idea offered to all other customers in the same way	Exclusive access to idea for defined time, offered first to us
	Ideas proposed	Ideas offered elsewhere first	Supplier offers many good ideas to us first
	Management attention	No high-level contact person	We have management attention / are a preferred customer
	Other relations	No business with us	Many other business relationships with us, that the supplier may not want to put at risk

Figure 5: Criteria for the evaluation of the innovating supplier (results from table 2)



Innovation Evaluation			Innovation A		Innovation B		Supplier Evaluation			Innovation A		Innovation B	
Criteria	Sub-criteria	Weight	Score A	Result A (weight*score)	Score B	Result B (weight*score)	Criteria	Sub-criteria	Weight	Score A	Result A (weight*score)	Score B	Result B (weight*score)
Market potential (cost / benefit)	Market situation	0,18		Score A * 0,18		Score B * 0,18	Employees of the supplier	Fluctuation	0,24		? * 0,24	?	? * 0,24
	Differentiation			Score A * 0,18		Score B * 0,18		Transparency			? * 0,24	?	? * 0,24
Influence on business model (external)	Sustainability	0,12		Score A * 0,12		Score B * 0,12		Cross-functionality			? * 0,24	?	? * 0,24
	Endangering the own business			Score A * 0,12		Score B * 0,12	Creative potential	Quality of ideas	0,19		? * 0,19	?	? * 0,19
	Scalability			Score A * 0,12		Score B * 0,12		Professional innovation management			? * 0,19	?	? * 0,19
Market / customer acceptance (demand solves customer problem)	Cost - benefit ratio	0,09		Score A * 0,09		Score B * 0,09		Implementation			? * 0,19	?	? * 0,19
	Customer segment			Score A * 0,09		Score B * 0,09	Endurance	Financial	0,17		? * 0,17	?	? * 0,17
	Customer value			Score A * 0,09		Score B * 0,09		Risk sharing			? * 0,17	?	? * 0,17
Cost - benefit analysis	Cost - benefit ratio	0,09		Score A * 0,09		Score B * 0,09		References			? * 0,17	?	? * 0,17
	Expenses			Score A * 0,09		Score B * 0,09	Preferential treatment	Exclusivity	0,09		? * 0,09	?	? * 0,09
	Sales volume			Score A * 0,09		Score B * 0,09		Ideas proposed			? * 0,09	?	? * 0,09
	Sales increase			Score A * 0,09		Score B * 0,09		Management attention			? * 0,09	?	? * 0,09
Proof of concept	General availability	0,08		Score A * 0,08		Score B * 0,08		Other relations			? * 0,09	?	? * 0,09
	Time / duration for implementation			Score A * 0,08		Score B * 0,08	Supplier Score			∑	Sum SA	∑	Sum SB
Innovation Score			∑	Sum IA	∑	Sum IB	Overall Score = Innovation Score + Supplier Score			IA + SA		∑	IB + SB

Explanation: ? = individual score (dependent on innovation or supplier) IA = Innovation Score for Innovation 'A' IB = Innovation Score for Innovation 'B' SA = Supplier Score for Innovation 'A' SB = Supplier Score for Innovation 'B'

Figure 6: Scoring model for the supplier innovation evaluation

Since the goal of this paper is to create an operational tool to evaluate supplier innovations, the results of tables 1 and 2 were taken and combined into one scoring model. Implemented scoring models normally use either regression or classification methods (Malthouse, 2002). In this research, the scoring model should create a ranking of supplier innovations, and through this classification, it should show which innovation will most likely be successfully implemented. The scoring model consists of two parts: First, it contains the evaluation of the innovation, and second, it comprises the evaluation of the supplier offering the innovation, as well. For both sub-parts, the evaluation variables were defined and clarified by experts who participated in the benchmarking and the World Café workshop. The most important aspects for the evaluation of a supplier innovation are shown in this model (figure 6). The weights for each criterion are derived from the expert ratings according to World Café 1. Consequently, each separate variable is weighted according to its significance. A practitioner using this model can select the innovations with the highest chance of being implemented.

Discussion and Implications

In this section, the key findings of this study will be discussed and an overview of the managerial and research implications shall be provided. This paper presents insights from a benchmarking study and from a World Café workshop. Sixteen German companies participated in the benchmarking and shared their innovation know-how in the innovation clustering (1) and innovation evaluation and selection (2) categories. Notable results from the benchmarking study are that the most popular evaluation method for innovations still seems to be gut feeling and experience. Moreover, all case companies use several clustering, evaluation and selection approaches for innovations, but none of them focuses on evaluating the supplier providing the innovation. To discuss these results and to further develop them, a second method was used – a World Café workshop. In the first part of the World Café, the experts discussed and expanded the identified factors from the benchmarking. After prioritizing the aspects that were selected in the first round, in the second round, two operationally usable checklists were developed to evaluate the characteristics of the external innovation and the qualities of the innovative supplier. Both checklists can be combined into one evaluation scoring model for supplier innovations.

The managerial implications

The results show that it is necessary to innovate the evaluation and selection process for innovations because, presently, supplier evaluation is neglected. Three aspects must be

considered: 1) A focus on potentially specific evaluation criteria for external innovations originating from suppliers (in contrast to internal innovations); 2) an evaluation of the innovative supplier and the inclusion of the result in the innovation evaluation score; and 3) the design of an operationally usable tool, whose purpose is helping innovation managers choosing the most promising innovation more easily.

Since in the automotive sector, for example, more than 75% of the value chain consists of suppliers and several studies show that 85% or more of all innovations are provided by suppliers. It is essential to focus the innovation evaluation and selection process on the specificities of external innovations (Dekkers et al., 2013; Roberts, 2001; Wolff, 2014). The developed innovation evaluation checklist places emphasis on five main criteria: "market potential", "influence on the business model", "market/customer acceptance", "cost-benefit analysis" and "proof of concept". Especially regarding the last two criteria, the kind of innovation plays a crucial role. This assumption can be illustrated as follows: If a buying company evaluates a supplier innovation that then shows for instance, very high potential by creating a unique selling proposition (USP) and solving central problems of all customers, then the following question arises: How is access to this breakthrough innovation gained and at which price? If the innovation was internally generated, this question would not be an issue at all. Viewed from the other side, it would also be possible that a very promising innovation (with a high score rating) will fail because of the bad performance of the supplier (e.g. worse project execution). This possibility shows the importance of the evaluation of the innovative supplier and the inclusion of the result in the innovation evaluation score. The supplier evaluation checklist focuses on four main criteria: "employees at the supplier", "creative potential", "endurance" and "preferential treatment". The first three criteria are only supplier-related, but the score of the fourth criterion, "preferential treatment", depends on the evaluating buying company. The score of this criterion may offer an indication of the probability of whether a company will gain exclusive access to an innovation or not. To receive preferential treatment, the buying company should have considered preferred customer status at the supplier (Hüttinger et al., 2012; Prahalad and Hamel, 2006; Schiele et al., 2012). According to Hüttinger et al., preferred customer status is defined as follows: It influences the behavioral intentions of the supplier to the extent that the supplier awards selected customers with more favorable treatment than others (Hüttinger et al., 2012). The benchmarking results show that the most commonly used evaluation method for innovations is "gut feeling and experience". Moreover, the research literature shows no ready-made evaluation model for supplier innovations. This lack implies that an operational and easy-to-use innovation evaluation tool is missing. Through this study, such an operationally usable tool was suggested. Naturally, this model is a first proposal, and some aspects must be further discussed. One question concerns whether, in the evaluation process, an order has to be followed or whether only one combined score is sufficient? Does it make sense to first evaluate the innovation and to then evaluate the corresponding supplier only for the best innovations? Alternatively, is it more useful to evaluate the supplier first, and only if the supplier receives a good score does it make sense to then evaluate the innovation? After all, if there is a good innovation but bad project execution, then the project will most likely fail.

As visualized in the matrix (figure 7), there are four potential result combinations: a "bad" innovation from a "bad" supplier (1); a "bad" innovation from a "good" supplier (2); a "good" innovation from a "bad" supplier (3); and a "good" innovation from a "good" supplier (4). That the innovations from category (1) are declined and the innovations from category (4) are launched as a project is quite obvious. However, what occurs with the innovations from category (2) and (3)? Perhaps it makes sense to also further develop the "bad" innovations from category (2) because through collaboration with a "good" supplier, it may be possible to enhance them. A common mistake is that the innovations in category (3) are implemented.

Although they are rated “good”, they fail because of the poor project performance of the “bad” supplier. Perhaps it would work better to either further develop the supplier or to buy the intellectual property (IP) of the idea or execute it with another supplier that is rated “good”.

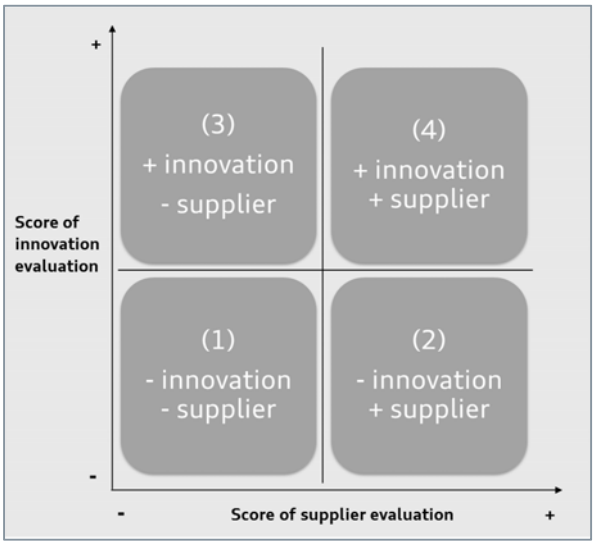


Figure 7: Matrix of the four potential result combinations of evaluating the innovation and the supplier offering the innovation

Another aspect of the developed scoring model that must be discussed is the weighting of the criteria. The weighting that the experts performed in the first round of the World Café workshop was used. As displayed in figure 6, in the current configuration of the scoring model, the criteria from the supplier innovation have a higher total weight (∑ of weights is 0.69) than the criteria from the innovation evaluation (∑ of weights is 0.56). This difference results from the fact that the experts distributed their votes for the most important criteria of the innovation evaluation across more aspects than in the votes for the most important criteria of the supplier evaluation. Therefore, the question is whether this weighting should be leveled to an equal weighting (e.g., such that the sum of the weights for each checklist is 100%) or whether it would perhaps be more useful for every company that uses this model to create its own weighting according to needs.

Research implications

Innovation research should focus more on the evaluation and selection process for innovations because there seems to be a lack of tools to use in operational innovation management. Moreover, the roles of the supplier and of the external character of supplier innovations must be further researched. Presently in many industries, most innovations are provided by suppliers (Dekkers et al., 2013; Schiele et al., 2012); therefore, the evaluation of the supplier and the inclusion of the evaluation results in the overall evaluation of the innovation considered are crucial.

Conclusion and Limitations

By analyzing the operationally used innovation evaluation methods and by developing an evaluation scoring model for supplier innovations, this paper contributes in at least three ways to the existing literature, as follows:

(1) This paper shows that, despite the fact that nowadays the majority of innovations are provided by suppliers, current innovation evaluation models largely neglect supplier-specific aspects. By developing and adding a supplier evaluation dimension, this paper closes an existing research gap left open by previous innovation evaluation models.
(2) Moreover, this study contributes to existing literature by providing two operationally usable checklists, one to evaluate the external innovation itself and another to evaluate the supplier providing the innovation. This checklists are combinable into one scoring model that evaluates a supplier innovation from two sides – the innovation criteria side and the supplier side.
(3) By analyzing the potential result combinations from the scoring model, a matrix with four categories was developed. Two previously not considered categories (matrix fields (2) and (3)) were discovered. The question is, how to proceed with this two categories in the future? If a "bad" innovation from a "good" supplier is spotted (category (2)), it perhaps makes either sense to further develop the "bad" innovation with the "good" supplier, because only the "good" supplier has the capability to enhance it, or to discard the "bad" innovation and maybe to start another project collaboration with the "good" supplier to execute another innovation project. Viewing matrix category (3), it seems to be a common mistake to implement this kind of "good" innovations from "bad" suppliers. Although they are rated "good", they fail because of the poor project performance of the "bad" supplier. So it may would be useful to try to continue this "good" innovation together with another supplier, which has a "good" rating.

In addition to the results discussed above, there are some limitations associated with this study. The benchmarking was performed with only 16 case companies, which is a small sample size. In addition, both the benchmarking and the World Café workshop were conducted with German companies only; thus, the results may not be generalizable to companies from other countries or continents. In future research, other kinds of companies (e.g., from other countries and continents) should be studied. Moreover, it would be useful to apply other research techniques and to employ, for example, a quantitative analysis to check and verify these results (especially the sub-dimensions of the innovation scale) with a larger sample size. Subsequently, a case study in which the scoring model is used would be essential to test its practice. In addition, the research on the evaluation and selection of supplier innovations, the role of the supplier and the "external character" of an innovation through project execution should be developed and further discussed.

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An evaluation framework for business services – a design science research approach

Martin Haensel

University of St.Gallen, Chair of Logistics Management, Dufourstrasse 40a, 9000 St. Gallen, Switzerland, martin.haensel@unisg.ch, Tel.: + 41 (0) 71 224 7288, Fax: + 41 (0) 71 224 7315

Abstract

The purchase and evaluation of business services is an important topic for companies. As research in this field is rare, the paper focuses on the acquisition and evaluation of services and aims to develop a framework for the evaluation of services that combines different determining factors. In more detail, the research combines investigations about the integration of the purchaser (as a link between the service providers and the internal customers) in different purchasing phases and the need for collaboration with both parties. These factors are expected to improve the various dimensions of the exchange described by IMP theory. In addition, four service types are included as contingent factors. Conclusively, all research results are merged to an evaluation framework using a design science research approach.

Keywords: service purchasing, business services, service evaluation, design science research

Introduction

Due to the increasing networking of production processes along the supply chain, companies increasingly focus on their core competences and outsource upstream and downstream processes. In light of this development, the external acquisition of business services has become a key success factor for manufacturing companies. Depending on the sector, this is reflected in a service proportion of up to 80% of the total purchasing volume (Hofmann et al., 2016). However, while the procurement of goods has long been subject to highly professionalized procedures, the typical purchasing manager continues to encounter problems and uncertainties in the procurement and evaluation of business services (van der Valk & Rozemeijer, 2009). Normally, these factors refer to different characteristics of business services in comparison to goods: the immateriality, the simultaneity, and the heterogeneity (Grönroos, 2008).

Another factor relates to the information asymmetry that accompanies the purchasing and evaluation (Laffont & Martimort, 2009). With the intention to overcome this information asymmetry, this research focuses on different determining factors on the purchasing and evaluation process. More precisely, the study investigates purchaser integration (PI) and collaboration with internal customer (IC) and service provider (SP) as determining factors. In that context, PI refers to different purchasing phases in which the purchasing department is directly or indirectly integrated (Axelsson & Wynstra, 2002). Collaboration is seen as result of internal or external integration (Schoenherr & Swink, 2012), leading to an enhanced information sharing and improved performance within a firm. The third determining factor on the purchasing and evaluation of business services addresses their heterogeneity. Due to the service-related heterogeneity, current research has led to a demand for different evaluation models for different business services (Haensel & Hofmann, 2017; van der Valk & Rozemeijer, 2009). This is justified by various assigned purposes of business services. While some companies acquire services exclusively for internal reasons (e.g., facility services and accounting services), other services are

directly integrated into value-adding processes (e.g., assembly services and logistics services) (Wynstra et al., 2006).

With a view to service evaluation, Alkin and Christie (2004) describe an anticipatory, an formative, and a summative evaluation phase. While the anticipatory phases empathizes the supplier selection, the formative phases concentrates on the supplier development and the summative phase assesses the service outcome. In all these phases, the collaboration (e.g., communication and the exchange of information) with IC and SP is crucial for a successful purchasing (Chakraborty et al., 2014). Due to different assigned purposes of a business service and different involved parties, the role of purchasers as well as their integration into different purchasing phases varies (Haensel & Hofmann, 2016). As research barely exists on service evaluation, the paper provides an advanced investigation into the aforementioned factors that need to be taken into account while developing an evaluation model for business services. In more detail, the research focuses on the following research questions:

> RQ1: How is PI, collaboration, and different services type (as determining factors) influence the purchasing and evaluation of business services?
>
> RQ2: In which way are these determining factors interconnected with each other and how do they have to be taken into consideration while purchasing and evaluating business services?

With the intention of providing answers to the research questions, the paper starts with an initial literature review of related research streams: the purchasing process and PI, the collaboration with involved parties, and the heterogeneity of services concerning a possible classification. As a theoretical foundation for collaboration, the paper introduces four dimensions of exchange induced by the industrial marketing and purchasing (IMP) theory (Håkansson & Snehota, 2006). In addition, a contingency approach is applied to account for the heterogeneity of acquired business services. As a methodological procedure, a design science research (DSR) approach is applied to combine insights from different and iterative research phases. The DSR approach allows the development of so-called artefacts (e.g., models, methods, and instantiations) (Hevner et al., 2004). Following the recommendations of Hevner et al. (2004), the results section describes the research process starting with an initial formulation of the design objectives, followed by the design and development stage as well as the demonstration and assessment of the designed evaluation framework. The last section discusses the research results and provides insights into their managerial and theoretical contribution.

Literature review

The first section focuses on existing research in the field of service purchasing and evaluation and presents a literature review of the most relevant literature streams. This includes (1) the service purchasing process, (2) the service type as a contingent factor, and (3) the purchaser collaboration with both IC and SP.[1]

Current service purchasing and evaluation as problem statement

Every purchasing activity can be explained as agency dilemma, assuming an information-asymmetry between both SP (agent) and buying firms (principal) (Jensen & Meckling, 1976). Due to the specific characteristics of business services in comparison to goods, the information-asymmetry is more distinctive in two ways. Firstly, it is not possible for a buying firm to test a service beforehand (Järvensivu, 2010). In consequence, the offer from SPs occurs always as a

[1] For the literature review, an approach by vom Brocke et al. (2015) was applied.

performance promise rather than as a guaranteed service outcome (Inklaar et al., 2007). Secondly, an evaluation of intangible services is more complicated in comparison to the assessment of physical goods as measurable criteria barely exists (Mitchell, 1994). Moreover, the intended outcome of a service often relates to external factors (e.g., the economic environment and other involved parties) that cannot be influenced by the SP (Reddy & Czepiel, 1999). With the intention of reducing the information asymmetry, literature provides two major strategies: signaling and screening (Spence, 1973; Stiglitz, 1975). Signaling describes the provision of information by the SP, whereas screening defines the assessment (evaluation) of a SP. Therefore, the evaluation can be seen as an instrument to reduce the information asymmetry induced by the agency theory. With a view to existing literature about evaluation procedures, most of the research focuses on goods purchasing neglecting the different characteristics of business services. However, several authors have investigated that topic as shown in Table 1.

Table 1: Excerpt of existing literature about the evaluation of business services

Author	Evaluated criteria	Service focus
Rottmann et al. (2015)	Utilization rate, amount of conversations, client's satisfaction, budget transgressions, innovative proposals, prevented legal costs	Legal Service
Cater-Steel and Lepmets (2014)	Service quality, system quality, service behaviour, service value, process performance, customer satisfaction	IT-Service
Hsu et al. (2012)	Web site design, security, customer relationships, enjoyment	E-Commerce
Vaidyanathan (2005)	Cost, services, IT, performance metrics, quality, intangibles	Logistics Service
Hsu et al. (2008)	Delivery and service quality, responsiveness, information sharing	Manufacturing
Kaynama and Black (2000)	Content and purpose, accessibility, navigation, design and presentation, responsiveness, background, personalization and customization	Travel Agency
Menon et al. (1998)	On-time shipments and deliveries, meet or exceed promises, availability of top management, superior error rates, responsiveness to unforeseen problems, financial stability, meet performance and quality requirements	Logistics Service

Most of the existing research focus on specific services (e.g., logistics services, consultancy, or legal services). A more generic perspective does not yet exist. While developing an evaluation procedure for business services one must consider several determining factors that influence the evaluation process. These factors are partially described in literature (e.g., the service strategy (Jothi Basu et al., 2015), the contract type (Selviaridis, 2016), and the buyer's qualification (Sharma, 1994)). However, there are still some determining factors in regard to a generic evaluation procedure for business services that have only received limited attention in recent research: the service type as a contingent factor, the purchasing phases and the PI, as well as the collaboration with both IC and SP during different purchasing phases. All three research-streams are discussed in more detail in the following chapters.

Purchasing process and PI as a determining factor for evaluation

Purchasing takes place in nearly every company and is considered to be one of the most important activities. Purchasing, however, does not take place at a single point of time, but rather occurs as a series of follow-up activities (Robinson et al., 1967). These different purchasing steps are also referred to as purchasing phases (Axelsson & Wynstra, 2002), in which the purchaser is directly or indirectly integrated. In that context, Robinson et al. (1967) describe one of the first procurement processes, whereby a distinction is made between numerous procurement steps. The same differentiation applies for the evaluation of business services. Typically,

during different purchasing phases criteria is evaluated with contributions from ICs, SPs, or other involved actors (Ellram et al., 2007; Rottmann et al., 2015). Before companies sign a service contract, IC and the purchaser must define requirements. Subsequently, a first evaluation (anticipatory) is carried out to determine whether a service offer meets the predefined requirements. After the usage of an acquired service, IC evaluates the service again and compares the outcome with the initial service promise (summative). In that context, Van Weele (2009) describes a pre-purchase and an "aftercare" process in which an evaluation takes place. Grönroos (2000) goes a step further and distinguishes between three different phases: the evaluation before, during and after the provision of a service. Following this argumentation, the purchasing department needs to be involved in most of these phases. Haensel and Hofmann (2016) support this position and name PI as an enabler for an informational and social exchange that occurs with SP and IC. In addition, Lejeune and Yakova (2005) also investigate the increased relevance of PI. In their research, they describe it as one of the most relevant success factors for supply chain management.

While looking at the exchange that takes place during the purchasing, IMP theory describes four dimensions of exchange: the informational, the financial, the service, and the social exchange (Håkansson & Snehota, 2006) (Table 2).

Table 2: Comparison of exchange dimensions induced by the IMP theory

Dimension of exchange	Description	Example
Social exchange	The social exchange does not directly relate to the service contract but describes the relationship between the buyer and the SP. With a view to the purchasing process, a social exchange is most relevant during the tendering, the contract closure, the negotiation, and the evaluation (Vargo & Lusch, 2004)	▪ The nature of communication (e.g., friendly, intriguer, fierce) ▪ The cultural or social background of SP
Informational exchange	The informational exchange includes any provision of data and knowledge directly or indirectly related to a service contract. This includes a mutual exchange between two parties, which is necessary for the fulfillment of orders. Since services are based on a performance promise, informational exchange becomes a decisive part of the evaluation (Haensel & Hofmann, 2016).	▪ Experiences or references from previous projects ▪ Information on production plans for the coming year
Exchange of services	In each procurement process, an exchange of services takes place, which describes the actual provision of the service. In contrast to the goods-dominant logic, this exchange is much more complex. This relates to the value co-creation, in which the buying firm is always involved (Vargo & Lusch, 2008).	▪ Provision of an consultancy service ▪ Transportation or warehousing of goods (logistics services)
Financial exchange	The financial exchange describes the payment for the SP. However, since the result of a service is often uncertain (Järvensivu, 2010), the success of a service cannot be completely guaranteed. For this reason, complex payment models often apply for services (e.g., performance-based payments).	▪ Payment of fixed prices or hourly based billings ▪ Differentiation between fixed and variable payment options

If a buying firm assesses the service outcome (and the SP), the evaluation must consider all of these dimensions of exchange. In that context, an evaluation of business services typically considers the service quality, mainly represented by the information, social and service exchange, as well as the service costs, shown by the financial exchange. While qualitative aspects such as the advance in knowledge of the SP is most relevant in the case of the provision of complex services (e.g., in the form of expert knowledge and innovative solutions), more standardized services typically consider the costs of a service. Another aspect of the IMP theory relates to the long-term adaptation and institutionalization. However, for the current research, the focus lies on the short-term exchanges due to its relevance for service evaluation.

The service type as a contingent factor for service evaluation

As previously mentioned, the service characteristics are different in comparison to those of goods. One major aspect in that context describes the heterogeneity of services (Axelsson & Wynstra, 2002). In goods purchasing, firms try to standardize components, gears, or parts of their products to reduce production and process costs. Within the field of business services, SP intend to separate themselves from competitors by providing a unique selling proposition. Due to the personal interaction, which a buying firm experiences while buying business services, every interaction between SP and the purchasing department appears as a unique situation. Therefore, it is difficult to offer a constant service quality. Lindberg and Nordin (2008) argue that the degree of objectification and specification varies depending on the acquired business service. In consequence, a distinction between different service types might be required while developing an evaluation procedure (Haensel & Hofmann, 2017).

With a view to existing service classifications, literature provides several categorizations for business services (Schneider & White, 2004; Smeltzer & Ogden, 2002). Typically, these classifications consider different requirements, different institutions, or viewpoints (Axelsson & Wynstra, 2002). Nevertheless, van der Valk (2008) argues that most of the existing classifications are not derived from a buyer's perspective but rather from a seller's perspective. Following that argumentation, Wynstra et al. (2006), therefore, introduced a classification that includes the usage dimension of business services from a buyer's perspective. They describe a categorization that differentiates between four types of services: consumption, instrumental, manufacturing, and component services. An description of these service types is shown in Table 3.

Table 3: Differentiation of service types (based on Haensel and Hofmann (2017))

Type of service	*Description*	*Example*
Consumption business services	▪ Applied and exclusively used by the buying company (no part of the offer to the end-customers). ▪ The purchaser is responsible for most of the purchasing process (incl. anticipatory, formative, and summative evaluation). ▪ Typically, the service is of lower importance in comparison to instrumental services and semi-manufactured services.	▪ Facility services ▪ Car rental service ▪ Travel services
Instrumental business services	▪ Services occur as a part of a company's own production processes, which increases the value of their own products or services. ▪ Due to the importance of the service type, the essential user typically is involved in the purchasing process. ▪ Moreover, the evaluation of SP includes the essential user, the end-customer, and the purchaser.	▪ Logistics services ▪ Assembly services
Semi-manufactured business services	▪ Services occur as an additional offer to end-customers, but are altered beforehand by the buying firm. ▪ Typically, IC of the services support the purchasing and evaluation process (but less than with instrumental services).	▪ Marketing services ▪ ICT services
Component business service	▪ Externally acquired services become an unaltered part of a firm's final offer to end-customers. ▪ The purchasing department is responsible for the purchase but seeks guidance from other company departments. ▪ Normally, the IC evaluates the service quality after usage.	▪ Maintenance services ▪ After-sale services

Although Table 3 lists various practical services, these are merely examples. Depending on the sector or company context, companies may have different uses for similar services. For example, a logistics service for a post-delivery supplier is likely to be an instrumental service since the service directly affects the core business and decisively influences the value of the company's own products or services. In contrast, equivalent logistics services for a manufacturing company could only be semi-manufactured services since the majority of the added value is

generated during the production processes and not during the transportation to other locations. However, based on the presented classification, it is expected that the service types are a contingent factor while purchasing and evaluating business services. Moreover, Haensel and Hofmann (2017) state that the service type also determines the scope of an evaluation and the collaboration with involved parties (e.g., SP, IC, and end-customers). This also includes a varying need for a social and informational exchange during different purchasing phases.

Collaboration as an enabler for service evaluation

With a focus on purchasing and evaluation, research on purchasing organizations and their buying behaviour represents an important literature stream (Johnston & Lewin, 1996). In this context, the collaboration between SP and the buying firm is most relevant aspect for a successful evaluation (Sheth, 1996). Martinez-Moyano (2006) describes collaboration as a process in which two or more entities work together to achieve common goals. Several authors examine various elements of collaboration in existing literature. Large (2005), for example, states that communication and an informational exchange are the basic elements of collaboration. In contrast to this argumentation, Danese and Romano (2011) focus their research on shared goals, visions, and production plans with SP and describe this as the most relevant exchange for a successful purchase (Chakraborty et al., 2014). In a practical context, purchasing organizations are normally divided into several subsectors (also called departments, ICs, or essential users). Typically, these departments announce a certain demand and, therefore, are the users of acquired services. In contrary, the buyer acts as the representative of each purchasing company, taking the position as a link between the IC (internal collaboration) (Hartley et al., 2014; Williams et al., 2013) and SP (external collaboration) (Chakraborty et al., 2014; Kumar et al., 2005). As mentioned before, Håkansson and Snehota (2006) describe four exchange dimensions between these parties. Morrissey and Pittaway (2006) argue that business services are characterized by a larger social and informational exchange compared to goods purchasing. This fact further increases when quantifiable criteria diminishes and so-called subjective criteria increases. This is again dependent on the service type.

In general, there is no doubt in an asymmetry of available information between SP and buying companies during a purchasing process (Laffont & Martimort, 2009). One focus of the collaboration is therefore to minimize this discrepancy (Haensel & Hofmann, 2018). However, Kopperger (2004) argues that in the area of business services a change of SP is rather unlikely compared to goods purchasing. This could be linked to a lack of information about alternative SP, which causes a difficult comparability. Nevertheless, collaboration during the purchasing is relevant for an evaluation in two different ways. (1) Firstly, collaboration strengthens the informational and the social exchange between the purchasing organisation, SP, and IC. Both types of exchanges allow a comprehensive evaluation of a business service (Vargo & Lusch, 2004). (2) Secondly, the need for collaboration varies in different purchasing phases. This means that in some phases it is more relevant to ensure collaboration with SP or IC. The type of service is expected to have an impact in that context, but this has not yet been investigated in existing research.

Research gap and related research objectives

Existing literature addresses several factors that determine the purchasing and evaluation process. Most of this research, however, focuses on the acquisition of goods and neglects the specific characteristics of business services. Although the effect of different determinants can be applied to both goods and services, various authors' state that a differentiated evaluation approach is required (Hsu et al., 2008). As a summary of the existing literature, the study identifies three research gaps: (1) Most authors agree on the heterogeneity of business services (Axelsson

& Wynstra, 2002). However, the impact on other aspects of purchasing, more precisely on the evaluation of business services, is not adequately addressed in existing literature. This lack of research on service types as a contingent factor also influences the following two research gaps.

(2) Existing research on purchasing describes different phases of purchasing (Grönroos, 2008; Haensel & Hofmann, 2016). In addition, several evaluation steps take place during these phases (Alkin & Christie, 2004). However, existing research does not examine the role of purchasers and their integration into various purchasing phases.

(3) The necessary collaboration of a buyer with SP and ICs, differentiated by the service type, is not examined in the existing research. Nevertheless, existing research assumes that the service type strongly influences the need for collaboration (e.g., social and informational exchange) (Haensel & Hofmann, 2017). Moreover, a service type's impact on the applied evaluation or its scope might vary and therefore needs extended scientific attention.

Design science research as methodical approach

The ultimate goal of the research is the development of a framework for the evaluation of business services that combines all aforementioned determining factors. To develop this framework, the study applies a design science research (DSR) approach. DSR describes a dominant research method that is used in engineering, operations research, and management science to provide innovative solutions for problems within a practical context (Hevner et al., 2004; Peffers et al., 2007; Winter & Albani, 2013). Gregor and Hevner (2013) categorize DSR as prescriptive knowledge aiming to develop new theories, constructs, models, methods, or instantiations. For these so-called artefacts, a further classification concerning their level of contribution is possible. While design theories describe abstract and mature knowledge, instantiations (e.g. specific products) are more specific and limited in nature (Gregor & Hevner, 2013). Even though DSR is different from explanatory research, both influence each other (Winter & Albani, 2013). Therefore, observed behaviour from explanatory research induces new needs and changed requirements for DSR solutions. DSR always focuses on real practical problems. Therefore, solution requirements and objectives are specified and validated. Moreover, the development process of designed artefacts occurs in an iterative process. An advantage of DSR is its ability to be combined with other research methods. Therefore, we followed the argumentation of Winter and Albani (2013) and combined different approaches (of qualitative and quantitate nature) during the design process. Moreover, a staged research process recommended by Seidel et al. (2017) is applied to allow numerous iterations. Figure 1 visualizes the conducted research process.

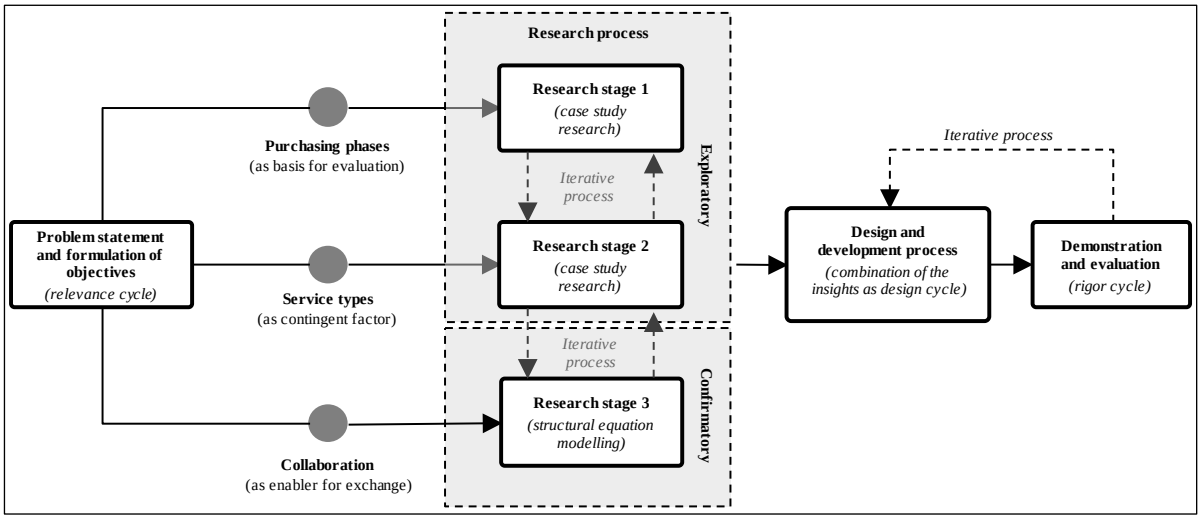

Figure 1: Research process of the design process

As shown on Figure 1, Hevner (2007) defines three cycles in DSR: the relevance cycle, the design cycle and the rigor cycle. While the relevance cycle sets environmental requirements and tries to ensure that the artefact is practically driven, the rigor cycle focuses on existing knowledge and scientific theories. The third cycle, the design cycle, describes the design building and evaluation process. However, both the relevance and the rigor cycle have been considered for the design process.

Problem statement and formulation of objectives

Starting with the problem statement and the formulation of initial research objectives, we identified three major aspects for our research that are fundamentally different from goods purchasing: the PI in different purchasing phases (Haensel & Hofmann, 2016), the service types as a contingent factor (Wynstra et al., 2006), and the collaboration as an enabler for exchange (Cousins et al., 2008). All three aspects are expected to influence the evaluation of business services. Therefore, the goal of our research was the isolated research of each factor followed by a combination of all insights within an evaluation framework.

Insights from the research stages

Within the ***first research stage***, we began examining the topic of the PI and purchasing phases by using an explorative case study research approach. The focus of the research was to allow a deeper understanding of the evaluation of business services and to reveal the impact of PI during different purchasing phases. The choice of case study research seems appropriate as our research was at an early stage and we were trying to investigate little-known phenomena (Eisenhardt, 1989; Miles & Huberman, 1994). The open-ended interviews, each lasting between three to five hours, were conducted with five multinational companies from Switzerland starting in autumn 2015 (Appendix A). All interviews were conducted with purchasing staff, including buyers, raw material managers, and executive purchasing managers (e.g., heads of indirect purchasing). To allow a comparison with the research stages 2 and 3, the focus of the interviews was already on the four different service types proposed by Wynstra et al. (2006).

The ***second research stage*** started in the beginning of 2016 and again applied an exploratory case study research approach focusing on the same case companies (Appendix A). To allow a comparison with the first research stage, the same company representatives were contacted for the interviews. Moreover, the impact of PI was analysed by using two major variables that influence the evaluation of service costs and service quality: collaboration with SP and collaboration with the IC (Danese & Romano, 2011). Based on the IMP theory, the research investigates the social, the informational, the service, and the financial exchange during different purchasing phases with both SPs and ICs.

In the spring of 2016, findings from both qualitative research processes were used to create a questionnaire that was used for the ***third research stage***. The confirmatory study investigated a direct and an indirect impact (e.g., through the buyers qualification) of PI on collaboration for different service types using a structural equation model. We contacted 2,500 companies in Switzerland, Germany and Austria (GAS countries). Due to different cooperation with organizations from Switzerland, Germany, and Austria, the study bases on four different databases that allowed the collection of 208 completed questionnaires. To provide answers for the research hypothesis, we used a partial least square analysis (PLS), a variance-based approach, for our study.

Research results of each stage

Altogether, the research in all three stages reveals that firms place a different assessment focus on different services and the effort involved in the assessment varies from service to service.

Thus, if companies employ, for instance, facility services (a consumption service) that are exclusively used for internal purposes they apply no advanced evaluation procedures for SP. If firms, on the contrary, acquire assembly services (an instrumental service), frequent and extensive evaluation takes place to assess SP. The analysis confirms findings from the qualitative stages and reveals differences depending on the type of service. With a view to IC collaboration, PI shows the most significant impact on value-adding services. When evaluating consumer services, our research shows an indirect effect through a buyer's qualification. This shows that the scope of exchange with SP and IC mediates the effect of PI within different purchasing phases and for different service types. The strongest impact shows up for component services. This might relate to their characteristics. Typically, these services come as an unchanged part and affect directly the offer to the end-customers (van der Valk & Rozemeijer, 2009).

Design and development of an evaluation framework

We presented the results of each research stage at international conferences for purchasing and supply chain management and published all revised papers in different international journals (Haensel & Hofmann, 2016; Haensel & Hofmann, 2017; Haensel & Hofmann, 2018). This procedure allowed us to receive feedback and inputs from the scientific community and resulted in several iterative cycles before concluding our final framework (Figure 2).

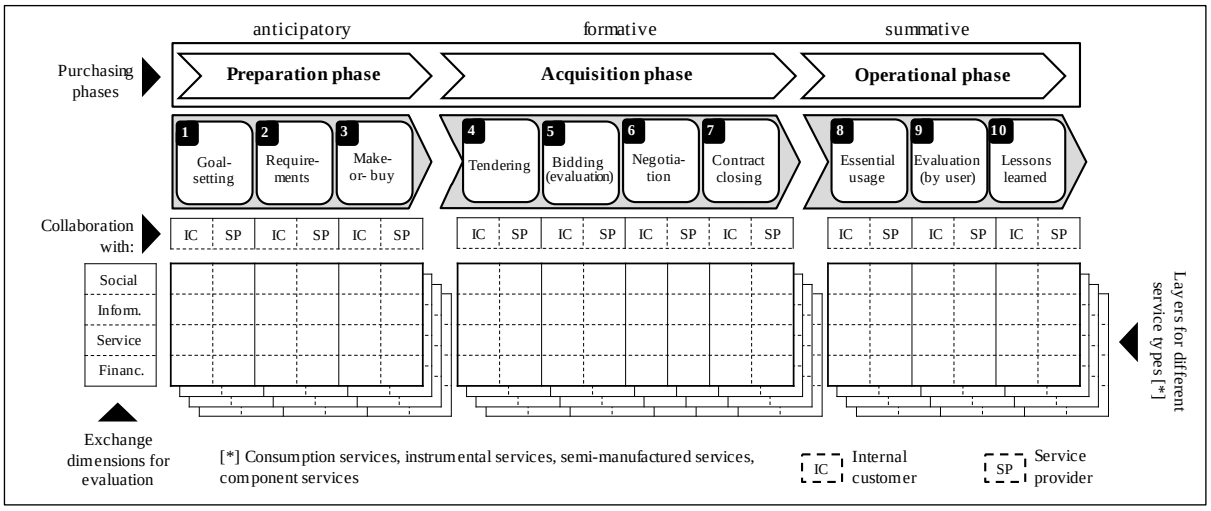

Figure 2: Framework for the purchasing and evaluation of business services

Our designed framework differentiates between three main purchasing phases before, during, and after the purchase (anticipatory, formative, and summative) and divides each main phase in several subsections (purchasing steps). This basis structure was derived from the first research stage and allows a focus on the different phases of a purchase. As the purchasing department is involved in all of these stages, the framework helps to define the necessary resources for different process steps.

In addition, we focused in our framework on the purchaser's collaboration with IC and the SP. For all three parties, the framework includes the exchange dimensions induced by the IMP theory. Consequently, the framework provides a matrix differentiating between the exchange dimensions (on the y-axis) and the involved parties (on the x-axis). While the column for the IC is used to determine a purchaser's exchange that is required for an adequate purchasing and evaluation, the column with the SP indicates the exchange dimensions that are evaluated by the purchaser. These aspects of the framework originate from the third research stage. Conclusively, the described matrices are a set of different layers that stand for different service types. Therefore, a structured differentiation of the exchanges with different involved parties, during

different purchasing steps for different service types is possible. These insights for the framework were derived from the second research stage.

Demonstration and evaluation

One essential step in every DSR approach focuses on the demonstration and evaluation of the designed artefact (Seidel et al., 2017). As our framework for the purchasing and evaluation of business services tries to provide support for purchasing managers, the focus group once again consists of employees responsible for the purchasing within their company, all of whom had been interviewed during the early research stages 1 and 2. The participants were asked to (1) cluster relevant services in accordance with their intended usage and (2) to rate the exchange with IC and SP during different purchasing phases by using Harvey Balls. This structured procedure helps firms to assign a purchasing department's resources in accordance with the relevance (the usage) of a service and to different purchasing phases. Figure 3 shows an excerpt of the completed template used for the demonstration and evaluation stage.

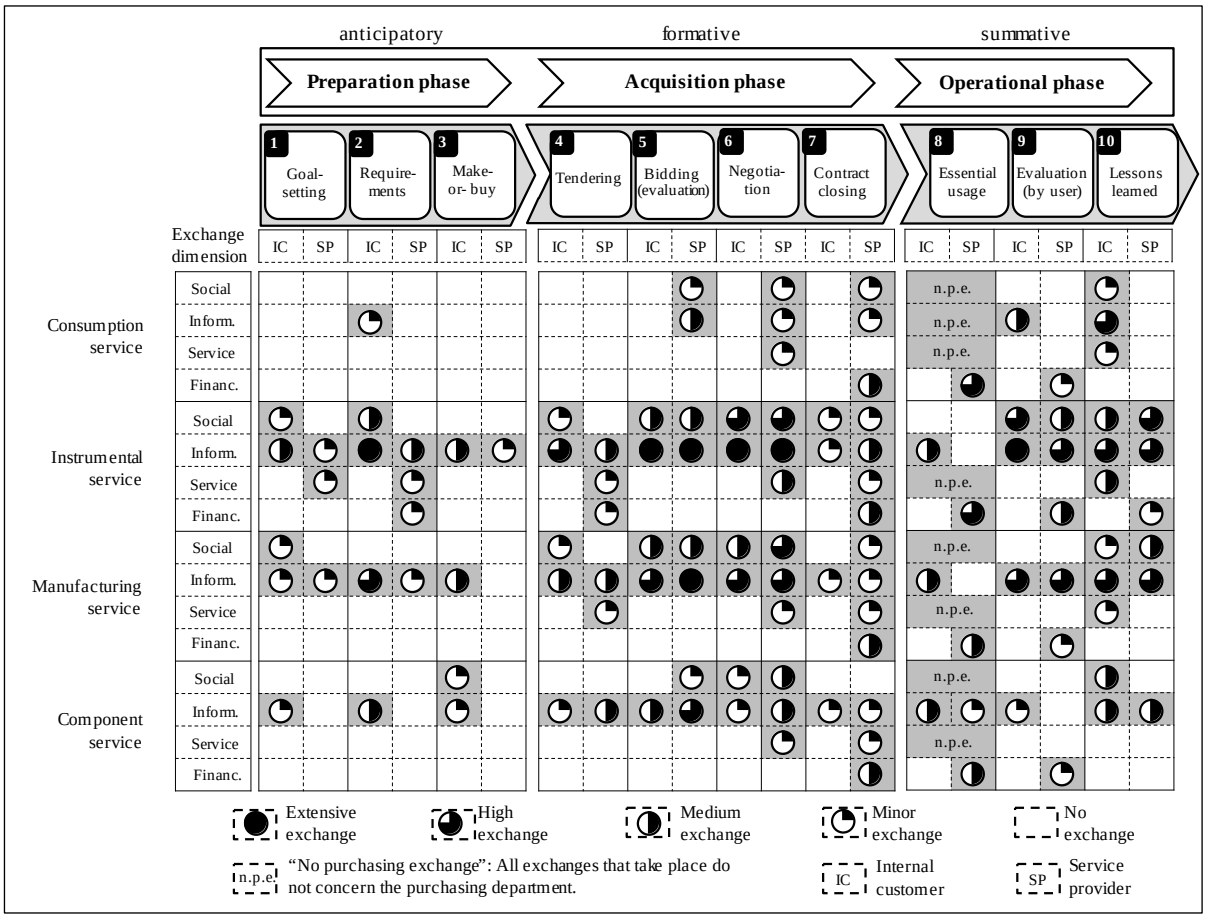

Figure 3: The need for exchange during different purchasing phases for different service types

In this context, it becomes clear that firms assign different resources to different services types described by Wynstra et al. (2006). Because of the fact that firms have to plan with limited resources, the scope of exchanges a company carries out during different purchasing phases varies. However, all insights from the demonstration and evaluation reveal the same picture that was discussed beforehand (Haensel & Hofmann, 2017). The exchange for instrumental services that increase the value of own products or services is always higher than for other services.

Discussion and implications

The aim of the research was to develop an evaluation framework that combines three relevant determining factors: the PI during different purchasing phases, the collaboration with both IC and SP, as well as the consideration of different service types as a contingent factor. The results show differences in the required evaluation effort, but also in the integration of a purchaser and their collaboration during different purchasing phases of a buyer and its integration into adequate evaluation procedures. However, the present scientific work does not specifically investigate the various evaluation procedures available, but instead assumes that they have a different degree of complexity and a clearly distinguishable effort that is required. This means that the investigation cannot predict which evaluation procedure should be used for a specific service. Rather, the work provides evidence that a different effort (e.g., in collaboration, PI, and evaluation) is required for different services.

Managerial implications

Starting with the managerial implications, the research shows that companies should always categorize their purchased business services based on their intended use. The proposed categorization of Wynstra et al. (2006) describes one possible differentiation. However, in the practical context, it may make sense to apply a more detailed classification for each service group. These results confirm early investigations by Haensel and Hofmann (2017), and extend research results from Wynstra et al. (2006) and Holschbach (2011). In addition, companies should collect evaluation methods that are available in their company and sort them according to their degree of complexity. This also means that firms have to determine the expected effort for implementing an evaluation procedure. Following this procedure, an allocation of evaluation procedures to different service types is necessary, whereby a complex evaluation procedure must always be used for the most relevant services.

Furthermore, it is necessary to implement a reasonable PI for each service type. Although the purchasing department is at least partially involved in each phase, it may be useful to reflect whether the available resources are truly being used for the most relevant services. In this context, firms should ensure collaboration with various entities involved in the process (mainly IC and SP). At this point, firms need to provide clear guidelines and strategies for exchanging information in various purchasing phases, taking the different types of services into account. Overall, the designed evaluation framework does not intend to evaluate services but helps firms to structure processes while evaluating service or for the development of an evaluation tool.

Theoretical implications

Following this argumentation, theoretical implications reveal based on the research. The research uses the exchange induced by the IMP theory as a theoretical basis for the investigation (the informational, the social, the service, and the financial exchange) (Håkansson & Snehota, 2006). Moreover, it is assumed that buying firms generally evaluate the dimensions of exchange in order to try to reduce the asymmetry of information that is postulated by the agency theory (Jensen & Meckling, 1976). However, depending on the service type, the observed exchange varies. Thus, the service type functions as a contingent factor for the IMP theory. Consequently, the research provides an extension of the IMP theory providing insights into the purchasing and evaluation of different types of business services. Moreover, literature on purchasing processes and on different service types is combined in our research, revealing a more sophisticated perspective. As a difference between the purchasing of goods and the purchasing of services is expected, the research helps to enhance the knowledge of the research stream of business services. This aspect also relates to suggestions from agency theory that postulates an information

asymmetry between the buying firm and SP. However, the research results focus on an enhancement of collaboration, PI, and evaluation that help to overcome this asymmetry.

An additional complexity driver in the area of service evaluation relates to individually tailored business services for specific purposes (Steiner et al., 2014). These types of services are excluded from the research and provide opportunities for future examinations. In addition, the investigation of the above services bases on a classification by Wynstra et al. (2006), which can be considered as one possible differentiation. Therefore, the impact on the management is applicable to the selected classification, but must be adapted individually to the respective company contexts.

Appendix

Appendix A: Overview about interview partners for research stage 1 and research stage 2

Study perspective		**Case characteristic**			**Number of interviews**	
Case	***Selection criteria***	***Size***	***Origin***	***Industry***	***Interview partner***	***Total***
C1	Large scale, domestic turnover and purchasing	Large	Switzerland	Postal service	Head of global purchasing; head of service purchasing	2
C2	Large scale, worldwide turnover and service purchasing, mass production	Large	Switzerland	Pharmaceuticals	Head of global sourcing; head of global warehousing	2
C3	Large scale, worldwide turnover and purchasing	Large	Switzerland	Engineering	Head of global purchasing; logistic purchasing manager	2
C4	Medium scale, trans-European turnover and service purchasing	Medium	Switzerland	Sanitation technic	Head of global purchasing; head of indirect purchasing	2
C5	Medium scale, trans-European turnover	Medium	Switzerland	Tobacco industry	Head of global operations; director procurement	2

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Digital Integration Capability as Driver of Supply Chain Performance

Jukka Hallikas, Mika Immonen, Kari Korpela, Jukka Sirkiä*
Lappeenranta University of Technology, School of Business and Management,
P.O. Box 20, FI-53851 Lappeenranta, Finland.
E-mail: jukka.hallikas@lut.fi, Tel.: +358 40 550 7499
**Saimaa University of Applied Sciences*

Abstract

Digital supply chain (SC) integration combines the information needed for product and service delivery within the supply chain and supports the management of the product life cycle for the customer. In this study, we show how the improved digital integration capabilities affect to the integration benefits and SC operational performance. Furthermore, the connection to the firm business success will be studied. This study provides a novel framework for structuring different digital integration capabilities with the SC performance. The results show that integration capabilities have a direct linkage to the SC performance which in turn influences on the business success of companies.

Keywords: Supply chain, Integration, Digital strategies

1. Introduction

Supply chain management focuses on optimizing goods and material flows by sharing and analysing the information about these activities (Chen & Paulraj, 2004). This information is delivered in internal and external business transactions. It has been recognized that digital technologies and platforms are needed to facilitate this information flow. Very recently, the use of competitive strategies under digital conditions has raised the question of how the product and supply chain is embedded into digital technologies. Supply chain management is focused on interactions within the supply chain. Previously, the downstream side was emphasised; currently, the upstream side is emphasises as the demand–supply chain digitalization (Schoenherr et al., 2015). As firms and industries become digitalized, they will form strategies by relying on information, communication and connectivity functionality (Bharadwaj, 2013).

Information technology, information gathering, sharing and exchanging among the participants are crucial elements in supporting the process integration and development of supply chain management (Neubert et al., 2004). To enable dynamic action and decision-making, information exchange and information quality are very important issues in coordination within the supply chain (Li & Lin, 2006). Both, firm internal and supply chain wide external integration are needed in effective digital supply chain information management. Internal integration is defined as the integration of information within a firm's boundaries across the firm's business functions (e.g. Richey, 2010). The main motivation for internal integration has been to improve real-time information sharing, manage businesses processes and build better competitiveness. However,

beyond internal integration, there is increasing need to build more effective digital integration across supply chains and networks. External information integration within the supply chain has become a vital element in integrating supply chains, and it has been supported by many standardization units. In the cases when possible it is important that integration of the business processes in a supply chain is based on standards (Aerts et al., 2004). In general the interorganizational coordination is achieved using electronic links between information systems which enable automated and digitalized processing of source-to-pay processes with suppliers and customers in the supply chain (Paulraj et al., 2006; Berente, N. 2009). Furthermore, supply chain information sharing and processing is not just limited to the business process transactional level. For example, product information, sensor data (Internet of Things, IoT) and unstructured social media information are shared via different platforms.

This study provides a novel framework for structuring a business process model that is based on global standards. In particular, it presents the methods used to analyse the data, and it discusses the interesting results. Previous research has highlighted that information integration and service automation are important business value drivers in supply chains (see e.g. Paulraj et al. 2006; Neubert et al., 2004; Hazen and Byrd, 2012; Segars and Grover,1995) In this continue to examine what is the role of digital integration capabilities in the supply chain integration and performance. The paper is structured as follows. We will firstly outline the development of digital strategy and supply chain integration. Then we develop conceptual model and hypotheses for the empirical research. The hypotheses will then be tested by using the collected survey data from the industry. Finally the discussion and conclusions summarize the main contribution and implications of the study.

2. Integration Strategy and Digitalization in Supply Chains

2.1 IT investments and the role of integrations in competitive advantage

The ongoing global digitalization has been predicted to become as a substantial change as industrialization was (Frey and Osborne, 2013). The amount of data available can be expected to grow very fast thanks to digitalization. Brynjolfsson and McAfee (2014) portrayed that “everything that can be digitized will be digitized and everything that can be automated will be automated“. Digitally enabled business may create a range of challenges as well as new opportunities. Digitalization has led to new ways of doing business, as well as threatening traditional ways of doing business with old operating models and legacy processes. Despite the process of digitalization, the goals of most companies and organizations stay traditional, such as achieving improvements in profitability, as well as improving quality, market share, returns on capital and the achieving better profit. The business landscape is changing turbulent and the disruption of many current business models has already begun (Weill & Woerner 2015).

Outdated and legacy systems support weakly integrations and a real-time data sharing and economy. Cost savings are achieved through digitalisation and automation of financial management processes, which significantly reduces manual work. Updating hardware and

software requires ongoing investments in time and money. Legacy systems and their limitations may prevent businesses from gaining a competitive advantage and inhibit business growth and scalability. Also decreased security is a concern when it comes to using legacy system. Many companies are still depend on systems firs developed about 30 years ago. Investments that have previously been seen as strategic decisions have now become costly and part of a complex legacy (Peppard and Ward, 2016)

McKendrick (2015) presents in a globally conducted study that 58% of executives say cloud software enhances their business processes. More and more businesses are investing cloud-based applications to handle their daily business. This software is summarised under the term Software as a Service. Davis (2015) present that almost two thirds of European small and medium-sized enterprises (SMEs) already using cloud-based applications and services. According to this extensive survey, cloud-based services have already been quite broadly accepted and the researchers forecast a strong growth in the near future. This may offers plenty of potential for business processes and IoT integration by software service providers on and integrators (Botta, et al. 2016; Korpela et al. 2016).

Peppard and Ward (2016) have presented that the four main types of the strategic system are the applications that:

1. Share or integrate data (information) via technology-based platform with customers and suppliers and deepen the relationship
2. Produce effective integration of the use of data (information) in the value-adding processes
3. Create opportunities for businesses to develop, produce, sell and deliver a completely new or improved services or product or new information based on a value proposition
4. Increase human cognitive processes insight for information and in knowledge; they provide a good opportunity for the leaders and professionals with information to support the introduction, development and evaluation of strategies

It is important to ensure that information systems investment strategies and plans reflect business strategies and objectives. And also prepare that the personnel has the capability and competences to achieve a great deal of benefits from information system investments.

Stafford (2012) describes important issues regarding the integration: matching data with the most suitable type of connection, ensuring complete error-free communication between systems, maintaining the level of security for data exchange and connections, managing a comprehensive integration scheme to transmit the right data at the right time to the right system avoiding data silos. Businesses do not only need to set up their integration services at the beginning to utilize the connection, but also have to monitor and manage the quality, accuracy and security of software integration (Stafford, 2012). System integration was previously implemented by investing a large-scale effort to manually transferring the information or by performing an individual and expensive integration project. The key objective of integration is to avoid manually transfer information from one system to another and get more real-time information. Similarly, data errors can be reduced and reporting can be automated from data from different systems. With accurate and effective integrations, the company and its ecosystems can achieve a significant competitive advantage.

2.2 Integration and interoperability in Supply chains

Earlier findings of systemic supply chain integration (Korpela et al. 2016), identified transformation requirements for digital supply chain. Business model development: Companies have to develop strategies and business models to most innovatively and effectively leverage digitalization and supply chain integration.

1) Information model development: The proper information models, that includes process and data model are needed to design the systems to collect, store and deliver information in supply chains.
2) Business process standards: ISO/IEC 19845:2015 business process standard for supply chain integration. This defines how the business transactions in the supply chains can be digitally connected.
3) Integration channel: Previously the operator or intermediators have built the services for data transfer between actors and their systems. Their role have been structuring the date between organizations and their systems.
4) Automating transactions: This enables companies to design inter-firm transactions based on commonly agreed business rules and automate digital supply chain.

It has been recognized that deployment of compatible technology, processes and standards improve the information exchange in supply chains. Furthermore, effective information exchange has been widely identified and acknowledged as a significant element of process integration, which has improved cost-effectiveness and overall supply chain performance (Croom, 2005) there are still some barriers for automating activities between the stakeholders in supply chains. High investment costs, incompatibility of software and hardware and the lack of awareness about the benefits of automation are identified to be the main obstacles to deploying advanced technologies ((Evangelista et al. 2012; Murphy and Daley, J.M. 1999).

3. Theoretical background and hypotheses

Integration in supply chain may be investigated in different levels of analysis. In this the supply chain integration is studies mainly in two levels where we firstly focus on the buyer-supplier relationships in supply chain and secondly to the integration of information and communication systems across supply chains. Vijayasarathy (2010) defines supplier integration can be defined as merging of parts into a whole. Supplier integration occurs on the upstream part of the value chain with those suppliers that are considered as most important and valuable for the buyer (Paulraj et al., 2006; Segars and Grover, 1995). In a similar vein, selling companies aspire to integrate downstream part of the value chain with mist important customers. Motives and explanation for supply chain integration comes from resource-based view (RBV) and transaction cost economics theories (TCE). Based on the RBV (Barney) the value of the resources is key for competitive advantage of the firm, and by integration is possible to combine resources of the buyer with those of the suppliers or logistics to generate competitive advantages (Wagner, 2003; Ordanini,and Rubera, 2008; Hazen and Byrd, 2012) TCE theory (Williamsnon 1975), provides rationale for integration based on the assumption that hybrid model of supplier cooperation referring to the closer cooperation reduces transaction costs of operations. Electronic business process management involves end-to-end interoperability within systems, which is explained in the

electronic data integration literature. In brief, the TCE perspective is that the firm economizes on transaction costs through the selection of internal governance costs for handling market transaction costs (Tsang, 2002). It can be assumed that with the digital supply chain platforms, which main purpose is to integrate, automate and streamline the data flow in the supply chain, it is possible to reduce the transaction costs in supply chain. This would possibly allow the realization of several strategic supply chain integration benefits and competitive advantage Competitive Advantage by Use of IT (Kearns and Lederer, 2003).

Figure 1 illustrates the conceptual framework of the study. In the background of the frame there are factors of top management commitment on digitalization, firms' capability for digital integration in supply chains and interoperability of digital solutions. These factors affect to the supply chain integration and supply chain performance which in turn influence on business success of companies. The items used to measure the factors are presented in the Appendix 1.

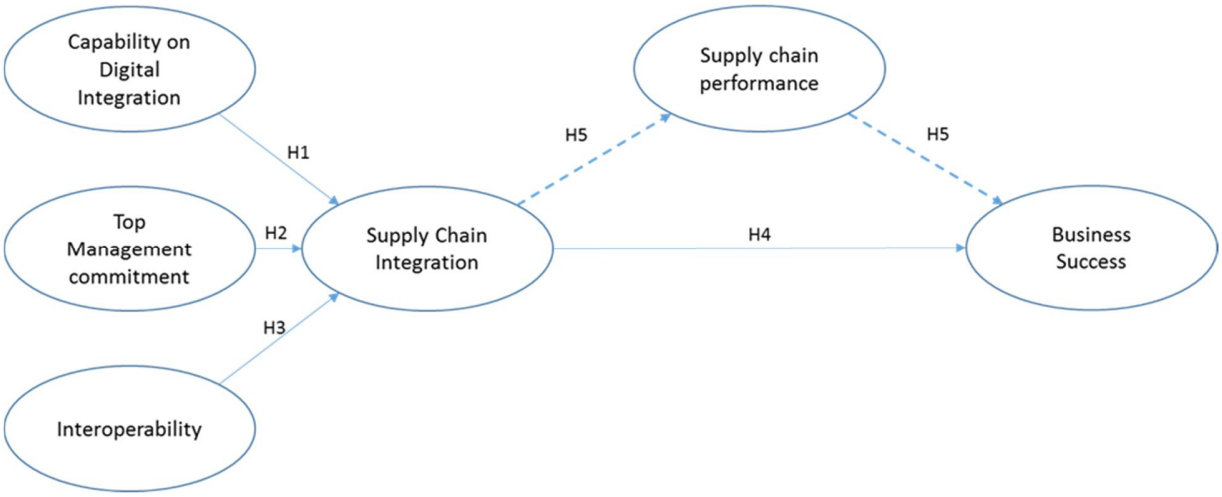

Figure 1 Conceptual framework of the study

3.1 Supply Chain integration benefits

Information technology contribute to better integration by fostering communication-based competencies (Paulraj, A., & Chen, I. J. (2006). According to literature, Inteorganizational system integration capabilities of companies influence on the supply chain integration success (van der Vaart & van Donk, 2008). Companies that invest on technical integration capabilities will get better supply chain integration (Chen & Paulraj, 2004). Thus, they recognize the potential benefits associated to the digital supply chain integration. Because integration capabilities require investments on top management support has an important role in the supply chain integration efforts (Chen and Paulraj, 2004). Top management support may facilitate resources and

investments to the digital integration capabilities which crucial for getting outcomes and benefits of information efforts. Information systems have been identified to foster integration with suppliers by sharing information with suppliers, establishing efficient communications, using common databases and implementing systems that enable linking of the buyer and supplier in real-time (Alfalla-Luque et al., 2013).

Essential capabilities in supply chain information integration include peer-to-peer links with suppliers, extranets that provide access of suppliers to the supply chain platforms of buying firms, and systems that integrate supply chain process transaction between companies transactional electronic data interchange (EDI) systems (see e.g. Shah et al. 2002). The interoperability of these systems requires commonly agreed open supply chain process interfaces as well as platforms that support inter-firm integration. Open supply chain standards (e.g. Edifact, UBL, ISO/IEC 19845:2015, RosettaNet) may provide uniform language for automated communication of transactional information between companies in supply chains. Furthermore, it is necessary that different supply chain systems are easily integrated to assure the interoperability of information. Open Source reference models to external integration are becoming a mainstream, where common standards are implemented to integration solutions. External integration e.g. Saas as a Service, public cloud and distributed platform technologies represents these mainstreams.

The technical interoperability of integration may be based on open interfaces and, for example, Application Programing Interfaces (API) integration solutions and management principles that allow different systems to transfer structured data based on API structure, designed by business processes and communicate automatically between each other. The use and maturity of information technology has linkage to the supply chains integration in the literature (e.g. Flynn et al., 2010). This can be illustrated, for example, by more optimized supply chain flows, increased accuracy of processes, and visibility of processes. The following hypotheses will be presented in order investigate the effect of digital integration capability, top management commitment and technical interoperability to the supply chain integration.

H1: Strategic integration capability of a company influences on supply chain integration?

H2: Commitment of Top management on Digital Integration influences supply chain integration?

H3: Interoperability of purchased information technology solutions influences supply chain integration?

3.2 Relationship between the supply chain Integration and performance

Relationship between information technology, supply chain integration and performance has examined widely but linkage is not self-evident (Daugherty et al. 1992; Gustin et al. 1994). Literature provides evidence for positive effects of information integration technologies influence on supply chain integration, which has a positive impact on performance, indirect at least (Li et al., 2009; Vickery et al, 2003, Wiengarten et al. 2012). Capability to share information among supplier networks has proven to not only increase flexibility but also directly contribute to the

operational performance (Bruque-Cámara et al. 2016). In the other words, the supply chain integration seem promote the supply chain performance and overall business success of companies (Ataseven & Nair 2017; Paulraj et al., 2006). The literature provides consistent support for the positive relationship between supply chain or supplier integration and company performance (Wiengarten et al., 2016;, Paulraj et al., 2006, Alfalla-Luque et al., 2013, van der Vaart & van Donk, 2008). In here, an important aligned concept is systemic value creation, which emphasize the integration benefits of lager networks of organizational systems (Immonen et al. 2015). In general, information technology enhances firm's supply chain logistics efficiency by providing real-time information regarding product availability, inventory level, shipment status and production requirements (Radstaak and Ketelaar 1998). In sum, the degrees of integration seems to lead to better outcomes by which we set the fourth hypothesis as follows.

H4: Supply chain integration has direct influence on the business success.

The supply chain integration seems to influence on the business performance through relatively high costs in implementation and providing advantages with regard both the customer value creation and the supplier engagement (Chang et al. 2016). Especially, the use of information technology in supply chain relationships has provided benefits in operational performance, visibility, faster delivery times, reduced transaction costs and improved inventory turnover (Ataseven & Nair 2017; Frohlich, 2002). For example, information technology has been promoted as an essential tool to ensure the logistics objective of providing timely service (Paulraj and Chen, 2006). However, the associated benefits of integration may not always realise and some studies have indicated even negative relationship between supply integration and performance (Swink et al., 2007). For example, the study by Huo et al., (2016) found no relationship between firm performance and supplier integration. To explain previous, it is necessary to investigate the drivers and outcomes of supply chain more in depth. The overall influences of the supply chain integration seems to depend on the context where appropriate level of product complexity has shown a common denominator for successful outcomes. The complexity refers the product attributes and relational complexity of the markets. In here, the positive performance outcomes have inverted U-shaped relationship to supply complexity, thus, always bounded with specific range of attributes (Ataseven & Nair 2017). Moderate level of complexity has proven to increase likelihood for success of the supply chain integration in general (Wong et al. 2015). In particular, combination of low product complexity and high market complexity are markers for potentially lucrative targets for investments (Wong et al. 2015; Ataseven & Nair 2017) In sum, the performance gains from the supply chain integration are sensitive for complexity of supply networks relationship and likely to have indirect effect on the business success metrics. By the previous, we set the fifth hypothesis as follows.

H5: The supply chain performance mediates the relationship between the supply chain integration and the business success.

4. Empirical Study

In order to map the status of the digital integrations and driver of supply chain performance in companies of different sizes, a survey with special focus on the subject was conducted. The study is based on the survey that was targeted to large and medium-size companies in Finland. The

sample consisted of over 500 companies. These companies were first contacted by phone in order to find the most suitable informant in the field of digitalization and supply chain management. Of those companies, 348 respondents agreed to participate in the survey, and a weblink to the questionnaire was emailed to them. A total of 101 answers were received, resulting in a response rate of 29% (101/348). The survey was presented online questionnaire in the Webropol system. The sample covered companies located all over Finland to ensure good representation of all the types of industrial companies encountered across the country.

Our target respondent group for the survey were the supply chain and IT managers in large and medium sized industrial companies. The respondents presented different industries including manufacturing, process industry, bio, energy and business service sectors. However, the participants were invited to participate to the survey as an individual experts. The developed survey instrument included the firm background information as well as different constructs with the measurement items. Survey instrument was pre-tested with the group of specialists before it was send to the respondents. Survey items were identified from the literature and cooperation with industry practitioners. The applied items and connected references have been illustrated in Appendix 1. The respondents evaluated the questions on a Likert scale from 1 to 5, where 5 indicated total agreement and 1 total disagreement and for a broader understanding the survey also included open questions. The questions were not mandatory, and the respondent was able to bypass individual questions. Due to this, the number of responses on individual questions varied.

4.1 Survey instrument

The measurement model was validated with regard to (1) measurement reliability, (2) validity of the factor structure and (3) discriminant validity of the measurement model (Gefen and Straub 2005; Henseler et al. 2009). The measurement reliability was assessed using construct reliability ('CR') and the variance captured by latent construct by average variance extracted ('AVE') (see e.g. Fornell and Larcker, 1981). The CR coefficient should exceed .50 to indicate acceptable if the model validity otherwise is good (Kline, 2011; Little et al., 1999). The measurement reliabilities are reported in the Table 1 where can be seen that all of the latent variables had good reliability for further analyses.

CRs of the latent constructs were acceptable varying from .773 to very high .926. Factor structure of the measurement model was analyzed by significance and weight of factor loadings, reliability, and validity and for cross-loadings between latent factors. All loadings in outer model (measurement model) were significant ($p<0.001$) and acceptable varying from .784 to .923. The convergent validity of all latent factors by AVE was acceptable higher than .50 for all measured concepts (Fornell and Larcker, 1981).We assessed discriminant validity of the measurement model (1) by cross loadings of the measurement items and (2) by the square root of AVE (i.e. Fornel-Larcker criterion) (Gefen and Straub 2005; Henseler et al.2009). The all measurement items were highly loaded to the defined latent factors and cross loadings did not reach level higher than .589. Furthermore, the square roots of AVE were significantly higher than correlations between any latent factors manifesting good discriminant validity of the measurement model.

Table 1 Measurement reliabilities

	Loading	t-value	p-value	Mean	SD	AVE	CR
Capability on Digital Integration (CDI)						**0,918**	**0,789**
CDI1	0,921	67,000	****	3.280	1.140		
CDI2	0,923	55,763	****	3.014	0.993		
CDI3	0,817	20,952	****	2.882	1.182		
Commitment of Top management on Digital Integration (CTMan)						**0,914**	**0,726**
CTMan1	0,807	18,418	****	3.667	0.954		
CTMan2	0,838	22,964	****	3.951	1.019		
CTMan3	0,900	40,606	****	3.892	0.997		
CTMan4	0,859	27,048	****	3.696	1.003		
Interoperability (Interop)						**0,773**	**0,631**
Interop1	0,798	7,811	****	4.013	0.761		
Interop2	0,790	6,665	****	3.864	0.914		
Supply Chain Performance (SCP)						**0,862**	**0,676**
SCP1	0,823	23,809	****	3.191	0.948		
SCP2	0,789	11,702	****	3.286	0.937		
SCP3	0,854	21,914	****	3.248	0.929		
Supply Chain Integration (SCI)						**0,858**	**0,668**
SCI1	0,854	29,419	****	3.078	0.922		
SCI2	0,784	14,903	****	2.920	0.962		
SCI3	0,812	17,960	****	3.259	1.006		
Business Success (BSuccess)						**0,926**	**0,757**
BSuccess1	0,909	33,440	****	3.321	0.817		
BSuccess2	0,832	18,251	****	3.447	0.872		
BSuccess3	0,882	25,832	****	3.248	0.849		
BSuccess4	0,856	24,097	****	3.323	0.891		

n) not significant, *) Statistically significant at p<0.1, **) Statistically significant at p<0.05, ***) Statistically significant at p<0.01, ****) Statistically significant at p<0.001

4.2 PLS Path Model

We analyzed main effects in the model which were defined by hypothesis one to seven (Table 2). In the analysis, bootstrap sample was size n=101 which equals to original sample. The resampling of the data was repeated 5000 times ("Basic Bootstrapping") in analysis which is adequate for estimation of parameters in the model (Henseler, Ringle and Sinkovics 2009; Kline 2011). We tested and validated quality of the structural model through the following steps; (1) collinearity issues and overall fit, (3) explanatory power, (4) path significances.

We assess the collinearity and the model fit to the data in order to validate the structural model which provides information on potential misspecification problems. VIF (variance inflation factor) of the latent constructs did not indicate collinearity issues where the values (VIF = from 1.073 to 3.247) remain clearly below critical value of 5. Because of hypothesis testing objective of the article, we need to asses over all fit of the structural model. For that purpose, we use standardized

root mean square residual (SRMR, critical value <.08) and root mean square residual covariance (RMStheta, critical value >.12) to specify estimation error and misspecification of the model (Henseler et al., 2014; Joseph F. Hair et al., 2014). Here, model fit by SRMR = .071 and RMStheta= .199 indicates that serious misspecification of the structural model does not occur. The r-squared for the latent variables in the path model were; "Supply Chain Integration " = .499, "Supply Chain Performance" = 0.464 to "Business Success" = 0.140. Overall, the explanatory power of the model is satisfactory regardless relatively low sample because the true phenomenon in focus is remarkably complex including multiple influences outside the tested model (Abelson, 1985; Prentice and Miller, 1992).

The default model (see Table 2) shows that the "Capability on Digital Integration" (CDI), the "Commitment of Top management on Digital Integration" (CTMan) and the "Interoperability" (Interop) have strong and significant positive influence on the "Supply Chain Integration" (SCI) which confirms the hypotheses H1, H2 and H3. In the tested main model, the Supply Chain Integration (SCI) has significant effect on the Business Success (BSuccess) which confirms hypothesis H4. By results, the supply Chain Performance (SCP) did not have mediator role for the SCI in the model by the found total effect, which lead us to reject H5. By the analysis, the supply chain performance (SCP) seems to depend on the level of the supply chain integration (SCI). However, we did not find significant influence of the SCP to BSuccess. We included several direct effects outside the main model into the PLS-path model as post-hoc purposes. The goal was to validate overall fit of the model to data and to assess role of the supply chain integration as part of the digitalisation strategies. Significant direct effects of the IT-strategy related drivers (CDI, CTMan or Interop) to the Business Success did not found. Following previous, the IT-strategy related drivers did not indicate any significant effects to the supply Chain Performance (SCP). To conclude, the post-hoc analysis shows that the supply chain integration (SCI) has a significant role as a mediator between IT-strategy and business performance.

Table 2 Direct effects in the structural model to test the main hypothesis of the study and post-hoc test for the effects of the ICT to Business performance

Hypothesis	**Path**	***β***	***T Statistics***	***P Values***
H1	CDI → SCI	0,465	6,415	****
H2	CTMan →SCI	0,237	3,190	***
H3	Interop → SCI	0,167	2,281	*
H4	SCI → BSuccess	0,358	2,610	***
H5	SCI →SCP → BSuccess (total effect)	0,063	0,855	0,393
"	*SCI →SCP (direct effect)*	*0,477*	*3,847*	****
"	*SCP → BSuccess (direct effect)*	*0,131*	*0,975*	*n*
Post-hoc test for the direct effects to validate overall model.				
	CDI → BSuccess	-0,084	0,599	n
	CTMan → BSuccess	-0,084	0,598	n
	Interop → BSuccess	0,023	0,203	n
	CDI → SCP	0,166	1,617	n
	CTMan →SCP	0,036	0,427	n
	Interop → SCP	0,135	1,519	n

n) not significant, *) Statistically significant at p<0.1, **) Statistically significant at p<0.05, ***) Statistically significant at p<0.01, ****) Statistically significant at p<0.001

5. Discussion and Conclusions

The study shows that Information technology brings possibilities to the supply chains, however, integration success seem to be the real driver of supply chain performance and further business success. Our findings illustrate that different levels of information integration activities seem to have essential role in leveraging supply chain integration and supply chain performance. The findings mean that information integration is the key enabler of supply chain providing required capabilities for effective integration. Identified facilitating factors include top-management commitment on integration, firm capabilities for integration, and interoperability of information systems. The findings also show that the digital strategies adapted by the firms may not have directly contribute on business success, but the influences are mediated thought the business activity level. In our data, the digitalisation influences on the businesses success through increased integration of the supply chains whereas similar mediation effect did not find with regard operational performance of the supply chains. We assume by the findings that the benefits of adopting the digital strategies are mostly related with fluency of the network wide flows and engagement of the actors into supply chains.

Earlier studies have identified that information integration technologies have a positive impact on company performance, (Li et al., 2009; Vickery et al, 2003, Wiengarten et al. 2012). This study contributes to the existing knowledge by investigating the impact of different levels (strategic, operational and systems) of digital integration on supply chain integration and performance. This study has shown positive relationship between integration and supply chain performance. The motives of supply chain integration has been highlighted in the literature. These studies have been recognized the positive relationship between integration and company performance (Wiengarten et al., 2016; Paulraj et al., 2006). This study has clarified the impact of digital integration and supply chain integration on performance. Furthermore, the positive relationship between supply chain performance and firm business success has been recognized.

Companies with successful histories need to adopt digital strategy if they will thrive in the future. Managers should see information systems and integrations as core to their business and some managers even still see these investments as an administrative costs. Managers should take a key role to manage information systems more strategically. To fully employ the potential of digitalization, the managers should redefine the concept of performance to cover network wide effects and to include indirect gains into accounting models which have traditionally been hidden from evaluators. An essential managerial implication of this study is that essential value potential of information systems in the supply chain is connected to the effective integration of information and communication systems across chains and networks. Effective integration provide systemic value to the supply chains with integrated business processes leading to speeding up supply chains, reducing costs, reducing errors and improving visibility.

The study has some limitations that should be addressed. The study was based on the survey data with rather challenging questionnaire for the respondent companies that show low integration level. This was also validated by feedback from respondents. Therefore, it is assumed that the sample does cover companies with higher integration maturity level. Further research on the digital supply chain integration will be focusing on the API and Blockchain integration. API offers structured data integration end to end digitally and Blockchain by its nature is decentralized

distribution of transactions recorded to common ledgers. Inter-firm contracting and Blockchain Smart Contracting can automate depending transactions in supply chain. These fully digitalized and decentralized integration technologies will re-shape the business models and innovations. We will closely research this technology deployment.

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APPENDIX 1 Items used in the survey instrument

Commitment of Top management on Digital Integration
(adapted from Chen and Paulraj, 2004; Boyer and Mc Dermott, 1999)

CTMan1: New investments on digital integration
CTMan2: Top management support for digitalization benefits to our customers
CTMan3: Top management understanding of digitalization benefits to us
CTMan4: Top management support for digitalization resourcing

Capability on Digital Integration
(adapted from Aerts et al., 2004)

CDI1: IT Management has plan for the digital integration
CDI2: Firm has capability and knoweldge of global standards for process integration
CDI3: IT management has clear vision on internal and external integration

Interoperability
(adapted from Peppard, J. & Ward, J., 201; Hallikas et al., 2014)

Interop1: We put a lot of effort into ensuring that purchased services are integrated so that they work smoothly together
Interop2: Purchasing of systems that support open interfaces and standards

Supply Chain Interation by Use of IT
(adapted from Kearns and Lederer, 2003)

SCI1: Influence the buyer's decision to switch to our product
SCI2: Make it more cost-efficient to add new suppliers to our supplier base
SCI3: Establish electronic links with suppliers or customers

Supply Chain Operational Performance
(adapted from McLaren et al., 2002; O'Leary, 2000).

SCP1: Digitalization reduce product or service costs
SCP2: Digitalization reduce errors through improved Information sharing
SCP3: Digitalization reduces supply chain lead time through information sharing

Business Success
(adapted from Germain, R., Droge, C., & Spears, N. 1996; Hendricks and Singhal, 2007).

BSuccess1: Dept Equity Ratio
BSuccess2: Netincome
BSuccess3: Return on Investment
BSuccess4: Profit

Collaborative Public Procurement: a conceptual framework

Christine Harland* Dip. Ingegneria Gestionale, Politecnico di Milano Via R. Lambruschini, 4/B, Edificio BL26/B, 20156 Milano, ItalyTel. 02 - 2399 4797, Email: christinemary.harland@polimi.it

Andrea Patrucco, Penn State University, Ross Administration Building, 100 University Drive, Monaca, PA 15061, USA

Jane Lynch, Cardiff Business School, Cardiff University, Colum Drive, Cardiff CF10 3EU, Wales

Yasmine Sabri, Dip. Ingegneria Gestionale, Politecnico di Milano Via R. Lambruschini, 4/B, Edificio BL26/B, 20156 Milano, Italy

Jan Telgen, University of Twente, Netherlands

Tunde Tatrai, Corvinus University, Budapest

*Corresponding author

Summary
Horizonal collaborative public procurement is where two or more public organisations collaborate to perform a procurement activity. A conceptual framework of 4 pillars is provided relating the objectives of collaborative public procurement to different forms and activities of CPP, to examine impact on performance of CPP. Barriers and enablers to CPP are also investigated. The framework is novel; prior work has focused only on specific pillars or the relationship between objectives and organizational form of CPP. The framework is tested empirically to verify the content of each pillar and test linkages between pillars.

Keywords
Collaborative public procurement, collaboration, inter-organizational

Submission category
WP

Introduction

Since the global economic crisis, public services have come under increasing pressure to do more with less, referred to as 'austerity'(Loader, 2011). Consequently, commissioners of government services are forced to cut spending and reduce system inefficiencies. One of the ways in which governments try to become more efficient is to stimulate or enforce more collaborative public procurement (CPP) (Schotanus, 2005; Walker et al. 2008). (Walker, Schotanus, Bakker, & Harland, 2013) endorse this point by noting that collaboration is often no longer an option but is written into policy as part of the political agenda. Whilst many types of collaboration have been identified (Walker et al. 2013) and benefits of collaboration have been acknowledged (Bakker, Walker, Schotanus, & Harland, 2008), there remains little guidance on how to do CPP better.

IRSPP is an international network representing 45 countries whose members are academics, practitioners, policy makers and purchasing professional associations including CIPS, NIGP, PiANO and NEVI (Knight et al., 2012). Bi-annually IRSPP conducts a major piece of research on a topic that the network members perceive as contemporary and important to public procurement practice internationally and CPP was proposed by the members as the topic for IRSPP7.

This paper reports the front end of the IRSPP7 study that sought to provide a conceptual framework for collaborative public procurement that could be used to guide the design and delivery of later empirical case study and survey research. Initially an operations management 'input-process-output' framework is used to review the literature on 'organisational type of CPP-process of CPP-output performance of CPP'. The literature is used to build 'pillars' in the framework containing elements expanding on type, process and output performance and, from the literature, a fourth pillar of 'objectives of CPP is added. Additionally barriers and enablers to each pillar are also elaborated. The developed framework and elements of each pillar are then tested theoretically, focusing on 22 collaborative public procurement papers, and empirically through a survey of 238 public procurement practitioners. The empirical findings show clusters of features of CPP and explain linkages between each of the pillars in the framework. They demonstrate how practitioners prioritise aspects of CPP, some of which are not represented in the literature. They also reveal areas emphasized in the literature that practitioners do not focus on. Both the theoretical and empirical testing support the conceptual framework, with minor additions. These findings are incorporated in the final version of the conceptual framework that contributes to knowledge on inter-organizational collaboration and public procurement.

Literature review

Collaborative public procurement is reviewed, then supplemented by a broader review of collaboration in public management and in inter-organizational networks.

Collaborative public procurement

The term 'collaborative public procurement' (CPP) is used here to describe the phenomenon of public organisations collaborating horizontally with each other to procure goods and services. Terms used to describe this horizontal collaboration include 'cooperative purchasing', 'group procurement', 'joint procurement' and 'shared procurement'. At least 45 different terms have been identified in publications relating to CPP (Essig, 2000) (Essig, 2000). Some of the more frequently used terms are featured in *Table 1*.

Table 1: Terms used comparable with collaborative public procurement

Type	Definition	Author/s
Cooperative purchasing	*The cooperation between two or more organisations in a purchasing group, in one or more steps of the purchasing process by sharing or bundling their purchasing volumes, information or resources in order to improve their performance*	(Schotanus & Telgen, 2007)
Purchasing group	*Two or more organisations that purchase together, either formally or informally, or through a third party*	(Hendrick, 1996)
Joint procurement	*Means combining the procurement actions of two or more contracting authorities. The key defining characteristic is that there should be only one tender published on behalf of all participating authorities*	Tatrai (2015, p.10)
Shared procurement	*Procurement of shared services refers to low value, commonly spent items such as janitorial supplies, administration items*	(Gordon Murray, Rentell, & Geere, 2008)
Purchasing consortium	*Consists of two or more independent organisations that join together, either formally or informally, or through an independent third party, for the purpose of combining their individual requirements for purchased materials, services, and capital goods to leverage more value-added pricing, service, and technology from their external suppliers than could be obtained if each firm purchased goods and services alone*	(Hendrick, 1996)

Consortium sourcing	*the combination of symbiosis and strategy - consortia are organized as symbiotic structural relationships between purchasing companies*	Essig (2000, p.16)

An alternative structure according to Murray, Rentall and Geere (2008) is shared service procurement which enables public bodies to "*maximise the benefits of both the intra-organisational hard core/soft core model and inter-organisational consortia participation*" and should be considered as an important option when public organizations may be smaller and /or lack resource and capabilities in procurement.

Reasons indicated for an increase in collaborative public procurement are the development of E-Procurement (Huber et al., 2004), shifting agendas from a short-term, internal focus to a long-term, external relationship focus (Dobler & Burt, 1996; Essig, 2000), an increased level of competition and cost pressure (Hendrick, 1996; Nollet & Beaulieu, 2005), an increased awareness and importance of purchasing (Walker et al., 2013), and the wish to counterbalance the power of large suppliers (Nollet and Beaulieu, 2005). Efficiencies gained from such collaboration can be termed 'collaborative efficiencies' and can be defined as: "*reforms that recognise and seek to resolve operating-cost interdependencies by creating multi-organisational arrangements to achieve levels of operating efficiency that cannot be achieved, or achieved easily, by single organisations*"(Elston, 2015).

There are many benefits associated with CPP which include economies of scale (Nollet & Beaulieu, 2005; Rozemeijer, 2000), reduction of transaction costs (Johnson, 1999), process cost avoidance (Schotanus, 2005), and improved relationships with suppliers and other organizations who are part of the purchasing group (Hendrick, 1996). Essentially the benefits can be categorized as improved efficiencies and improved effectiveness (Jost et al., 2005, Schotanus and Telgen, 2005, 2007; Walker et al. 2006, 2008). Improved efficiencies can be achieved by reducing transaction costs, bundling purchasing activities together and achieving economies of scale, while improved effectiveness can be reached through a focus on quality enhancement of the goods or services purchased through the collaboration, as well as a more effective execution of process activities, such as learning from other participants in the collaboration (Bakker et al 2008). Enhanced supplier relationship management arising from the collaboration may increase innovation or improve risk management (Patrucco et al., 2017). Reported disadvantages of collaborative procurement include a potential increase of complexity of the purchasing process (Tella & Virolainen, 2005), loss of flexibility and control of procurement activities (Schotanus, 2005), increase in coordination costs (Johnson, 1999), and a need to change and adapt specifications (Schotanus, 2005).

CPP research so far seems to have contributed to collaboration type, collaboration process and collaboration outputs but we find there is no one framework within the CPP literature that integrates these.

Collaboration in public management

One of the main concerns in public management is the complexity of the portfolio of social, economic and environmental problems where responses to form solutions often involve collaboration between public organisations because of shared or similar goals (Gray, 1985; (Agranoff & McGuire, 2004). There are many government policy areas where it is recognised that collaboration across government agencies is required, for example to tackle crime, manage urban areas, provide social services and improve national security. However, following from the global financial crisis, increasingly it is being recognised that collaboration across government bodies is also essential to yield significant savings in operating costs (Bovaird, 2014). Collaboration to integrate back office functions such as HR and IT may yield

efficiencies (Knol et al., 2014; MacCarthaigh, 2014; Elston, 2015). Collaboration across front line government service providers to form 'one-stop-shops' for citizens (Reid, 1995) can also give rise to efficiencies.

Collaborative networks are the most common type of interorganizational network found in public and not-for-profit sectors (Eisingerich, Rubera, & Seifert, 2009), (Kimberley R Isett, Mergel, LeRoux, Mischen, & Rethemeyer, 2011) (Popp, MacKean, Casebeer, Milward, & Lindstrom, 2013). Collaboration in these interorganizational networks is often intersectional, among business, government, non-profit organizations, communities and/or public as a whole (Bryson, Crosby, & Stone, 2006; Rethemeyer & Hatmaker, 2008).

Collaboration across government agencies not only helps to tackle complex problems but also enables the sharing of scarce resources (Keast, Mandell, Brown, & Woolcock, 2004) (Bryson et al., 2006), (Hoberecht, Joseph, Spencer, & Southern, 2011; Weber & Khademian, 2008), Collaboration can help to improve efficiency, legitimacy, power and manage uncertainty (Hoberecht et al., 2011; Kimberley R Isett et al., 2011; Kimberley Roussin Isett & Provan, 2005; Pesämaa, 2007). It has been claimed that they can improve service delivery, advance innovation, support risk distribution and share accountability (Pesämaa 2007, Hoberecht, Joseph et al. 2011) enabling key managers to understand bigger, more sustainable solutions (Hoberecht, Joseph et al. 2011) that individual organizations and managers cannot achieve independently (Provan & Kenis, 2008; Weber & Khademian, 2008). In particular, wicked problems such as poverty and global warming, and reform of complex services such as education and healthcare, cannot be solved by single agencies, organizations and even sectors (Huxham and Vangen 2005, Hoberecht, Joseph et al. 2011). These complex problems facing society provide a "moral imperative" to collaborate across organizations and sectors (Popp et al., 2013).

Interorganisational network collaboration

Much of the focus on collaboration across private sector organisations has been on trying to achieve efficiencies to generate cost savings (Vereecke & Muylle (2006) (Min et al 2005), Essig (2000). Interorganizational networks come in a variety of forms of cooperation including joint ventures, strategic alliances, collaborations and consortia (Podolny and Page 1998), though some view them as informal, social, rather than legally bound constellations of organisations (Barringer & Harrison, 2000).Interaction between organisations in business to business dyadic relationships lead to longer term relationships becoming institutionalised (Ford & Group, 1990; Håkansson & Group, 1982; Håkansson & Laage-Hellman, 1984; Håkansson & Snehota, 1989)..

Supply chain management can be conceptualised as occurring at different levels – within organizations, relationships, supply chains and networks of organizations (Christine M Harland, 1996). Interorganizational supply network activities include partner selection, resource integration, information processing, knowledge capture, social coordination, risk and benefit sharing, decision making, conflict resolution and motivating (C. Harland, Zheng, Johnsen, & Lamming, 2004; Christine M. Harland, Lamming, Zheng, & Johnsen, 2001; Johnsen, Wynstra, Zheng, Harland, & Lamming, 2000). Management of, and in, interorganizational networks is through six network management roles - network structuring agent, coordinator, advisor, information broker, relationship broker and innovation sponsor (Christine M Harland & Knight, 2001; Knight, Harland, Walker, & Sutton, 2005).

All 150 papers reviewed were analysed, coded and mapped onto the initial conceptual framework of type, process and output performance of CPP. In addition to this mapping, it was

observed that many papers also addressed the objectives of collaboration and what was enabling or constraining collaboration from occurring. This led to 5 main 'pillars' in the conceptual framework rather than 3. Within each pillar elements relating to that pillar were recorded. For example, papers examining organisational design discussed organisational form, dynamics among group members (e.g. motivation, decision making, conflict resolution, trust, number of members), and members' roles (e.eg. collaboration coordinator, collaboration leader, technical advisor). These 'elements' provided the content of each 'pillar'

Methodology for testing the conceptual framework

Theoretical testing method

The initial literature review used keywords of "collaboration", "procurement" and "public administration" and combinations of these, yielding 150 papers. To test the initial conceptual framework and the additional content from the broader literature review we focused on a subset from the 150 of 22 papers that focused on public procurement considering both the content (evaluating title, abstract, and the full text) and the journal relevance, as suggested by McGuire (2006), Quintens et al. (2006), Pagano (2009), and (Spina, Caniato, Luzzini, & Ronchi, 2013). Only ABS ranked journal papers were included in the search. As a result 22 papers from 8 operations and supply journals 5 public administration journals remained for in depth analysis to see if they supported the conceptual framework design.

Empirical testing method

A questionnaire survey was designed to collect data on collaborative public procurement projects. It was divided into six sections: the first on general data on the institution, respondent and CPP project, the next five on CPP objectives, type, process, performance, and barriers and enablers. Piloting was conducted to improve item wording, reduce survey length and improve translations. 238 institutions in the IRSPP network contacts agreed to participate, and out of these, 161 useable responses were received, yielding a 10% response rate of the total sample and a 67% response rate of those who agreed to respond. To test the validity of the pillars and of the items included in the conceptual framework, we ran an Exploratory Factor Analysis (EFA. Only items with factor loadings of at least 0.4 were retained. For each of the obtained constructs, we measured reliability.

Findings and discussion

Findings from the theoretical testing

Table 2 below summarises findings of the pillars and elements from the conceptual framework found in the in depth analysis of the collaborative public procurement literature.

Table 2: Support for pillars and elements of conceptual framework

PILLARS AND ELEMENTS OF CONCEPTUAL FRAMEWORK	NUMBER OF PAPERS ADDRESSING THESE
Objectives of collaboration	
Efficiency	6
Quality	2
Competence enhancement	3
Relationship development	4
Broader government objectives	0
Total objectives of collaboration	**15**
Collaboration organisation	
Organisational form	3
Dynamics among group members	6
Members' roles	3

Total collaboration organization	**12**
Collaboration process and tools	
Operational activities	4
Managerial activities	1
Strategy forming activities	3
Policy forming activities	1
Tools	0
Total collaboration process and tools	**9**
Collaboration output performance	
Efficiency savings	12
Effectiveness improvements	7
Strategic performance improvements	4
Total collaboration performance	**23**
Barriers and enablers to collaboration	
Level of partner involvement	**7**
High level support	6
Total barriers and enablers to collaboration	**13**

The theoretical testing supported the general architecture of the framework, but did not confirm all the elements of each pillar or any linkages between pillars

Findings from the empirical testing

Table 3 reports results of the Exploratory Factor Analysis

Table 3: Exploratory Factor Analysis

	Construct	Items	Loading	Cronbach alpha
OBJECTIVES	Efficiency	Optimize supply base	.741	0.785
		Standardize and rationalize needs	.714	
		Obtain savings, gain economies of scale	.635	
		Decrease procurement process cost	.620	
		Centralize procurement management	.614	
	Competence enhancement	Improve management of procurement risk	.808	0.691
		Lack of skills	.790	
		Increase procurement competences	.728	
	Relationship development	Improve relationship with potential suppliers	.886	0.751
		Improve relationship with other institutions	.857	
ORGANIZATIONAL DESIGN	Dynamics among group members	Conflict resolution	.859	0.895
		Motivating	.857	
		Decision making	.744	
	Group members roles and responsibilities	Collaboration coordinator	.915	0.766
		Collaboration leader	.891	
		Technical/ specification advisor	.655	
PROCESSES	Policy forming activities	Social/community benefits policy	.860	0.760
		Environmental sustainability process	.846	
		Ethical sourcing process	.846	
		Local economic development policy	.777	
		Risk analysis and management	.851	0.859

	Managerial activities	Demand analysis and management	.843	
		Regulation/compliance management	.819	
	Strategic sourcing activities	Sourcing strategy	.858	0.778
		Relationship strategy	.772	
		Innovation strategy	.765	
	Sourcing activities	Tender procedure selection	.870	0.757
		Technical specification documents preparation	.816	
		Tender evaluation	.798	
PERFORMANCE	Effectiveness	Optimize supply base	.867	0.794
		Reduce supply base	.819	
		Improve relationship with other institutions	.743	
		Improve relationship with potential suppliers	.667	
	Efficiency	Obtain savings or avoid additional costs	.805	0.804
		Decrease procurement process cost	.786	
		Increase procurement quality	.738	
	Risk management	Outsource management of non – strategic procurement	.803	0.672
		Improve management of procurement risk	.746	
ENABLING FACTORS	Partner involvement	Information brokering/ sharing	,758	0.701
		Knowledge capture	,740	
		Commitment of partners to invest time	,729	
		Risk and benefit sharing	,622	
	Government support	Political support	,933	0.843
		High level support	,924	

The final revised conceptual framework contained the additional findings from the theoretical and empirical testing. Elements not viewed as important by either literature or practice but featuring in the other were retained as they represented potentially interesting areas to explore further.

Revised conceptual framework

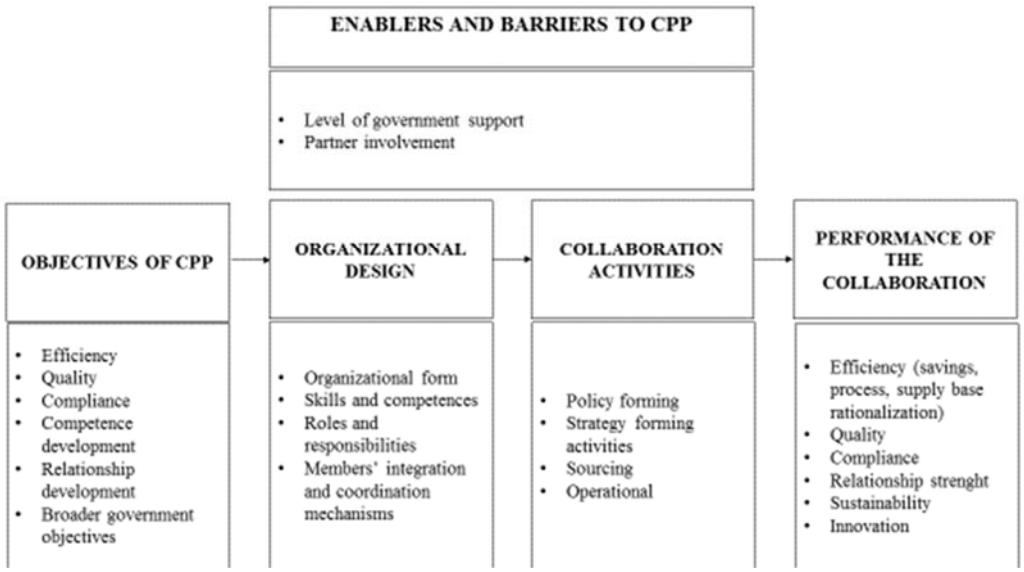

Figure 1:Revised conceptual framework

Conclusions

Whilst there have been contributions to knowledge on Collaborative Public Procurement, to date there has not been evidence of understanding of the objectives, type, process, performance, and barriers and enablers. Most significantly there has not been any empirical testing on how these 'pillar' of CPP are inter-related. This working paper provides a summary of the analysis to date supporting a conceptual framework for Collaborative Public Procurement. This framework is applied in subsequent analysis of the empirical data in the rest of the IRSPP7 study. It can also be used to guide research in Collaborative Public Procurement.

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Investigating News Reporting on Public Procurement: A Manifest Content Analysis

Irina Harris and Anthony Flynn
Logistics and Operations Management, Cardiff Business School, Cardiff University.
Aberconway Building, Colum Drive, Cardiff CF10 3EU
(HarrisI1@cardiff.ac.uk), Tel. +44 2920 74447 and (FlynnA2@cardiff.ac.uk), Tel. +44 29208 75890

Abstract
The purpose of this paper is to examine how public procurement has been reported on in newspapers over the last two decades. The print media, newspapers in particular, provide an authoritative source of information on the policy and practice of public procurement. However, there has been few attempts to understand their reporting of it. In response, our research investigates Financial Times news coverage of public procurement between 1996 and 2017. Preliminary findings indicate that the tone of reporting has changed in the last two years, with the focus shifting from supranational regulations to specific procurement activities (e.g. school building). In addition, the articles over the entire 1996-2017 period have limited reflection of areas discussed in academic literature, such as sustainability, SMEs and value for money.

Keywords: public procurement, content analysis

Introduction

Public procurement is never far from the news in most countries. At any given time readers are likely to come across stories of public procurements gone wrong, waste and/or corruption by public servants and complaints by suppliers over perceived unfair tendering procedures. For example, one case that featured prominently across media outlets in recent years involved a "flagship" IT system procured by the UK government to manage immigration applications (Barrett, 2014). Despite costing £350 million, the system was not fit for purpose and later mothballed. Admittedly, it is not all bad news. Stories referring to policies and initiatives targeting greater small supplier involvement in public sector supply chains can also be found alongside examples of major cost savings achieved and efficiencies implemented.

News reporting on public procurement is important in two main respects. First, it provides an authoritative insight into what are the key issues and debates in public procurement at a given moment in time. These issues and debates are not trivial. Public procurement accounts for, on average, 13 per cent of GDP and 29 per cent of annual government spending across OECD countries (OECD, 2013). How it is managed and whose interests it is understood to serve has ramifications for the delivery of public services, national finances, economic competitiveness, employment, and much else besides. Second, news reporting shapes our understanding on what role public procurement can and should play in public administration. It legitimises and even helps to institutionalise certain practices and viewpoints.

In spite of its prominence, there has been little academic engagement with news reporting of public procurement. Instead, research has either concentrated at the level of the buying or supplying organisation and the individual buyer or supplier (Flynn and Davis, 2014) or government procurement regulations and policy documents (e.g. Kidalov and Snider, 2011; Thai, 2001). A number of possible explanations exist for this situation, including: the relativeness newness of public procurement as a field of scholarly inquiry and methodological

challenges associated with searching for and then interpreting and coding large volumes of news data on public procurement.

Because of the lack of prior consideration given to media reporting as a data source, public procurement is missing an important perspective - one that has the ability to track changes in its meaning and characterisation over many years. The aim of our research is to address this gap in knowledge. It does so, firstly, by drawing attention to the relevance of media discourse to our understanding of public procurement. It then invokes the literature on institutional fields in order to provide a framework and theoretical ballast for our research. Thereafter, it sets out a research design based on manifest content analysis. In these ways our research endeavours to make empirical, methodological and theoretical contributions to the field.

Institutional Fields

To help make sense of news reporting on public procurement we turn to ideas associated with institutional theory and institutional fields. By institutional field is meant all the actors and organisations that together constitute a marketplace or sector (DiMaggio and Powell, 1983:148). Public procurement as an institutional field comprises public buyers, suppliers, regulators, legislators, industry bodies, professional institutes, communities and the media, among other stakeholders. Institutional fields are more than a network of actors, however. They are "centres of debates in which competing interests negotiate over issue interpretation" (Hoffman, 1999:351) and "arenas of power relations" (Brint and Karabel, 1991:355). It is through debates and shifting power dynamics that institutional norms and beliefs are shaped and reshaped as new players populate the field and the nature of their play changes over time (Davis and Marquis, 2005). These ideas provide the starting point in developing a theoretical framework for our study.

Research Design

The research method involves an analysis of Financial Times newspaper articles on public procurement. Table 1 presents key elements related to the research design. One of the limitations of the research is that only "public procurement" keyword was used. In future, other terms such as "public purchasing" will be included to expand the analysis. Our study uses Text Analytics Toolbox through visualisation of the data using WordClouds. At the start of the process, the data was prepared for text analysis: loaded and extracted, full text was prepared for tokenizing and an array of tokenized documents was created where a list of stop words (e.g. "a", "and" and "the") was removed. The Porter stemmer function was used to group different forms of English words by reducing them to a common stem, the bag-of words model was created and less frequent words removed. The WordClouds were then used to compare articles labelled by year and subject term.

Table 1. Research design.

Dimension	Detail
Analytical method	Manifest content analysis
Data type	Secondary data
Data source	Financial Times digital archives (from ProQuest ABI/INFORM Global)
Time period	1996- Sept 2017 (data was extracted on 19 October 2017)

Keywords/Type/Language	'public procurement' / Document type: News/ English

Preliminary Findings

In total, 472 articles were sourced using "public procurement" keyword search. Table 2 presents selected data attributes obtained from the database and used in the analysis (year, author, title, abstract, full text, subject terms). Other attributes were also available, such as publisher but they were not considered because all articles had the same publisher. As can be seen, only articles between 1997 and 2011 have abstracts and only a small number of the sample has one or more subject term present (main concentration is 1996-2005).

An initial assessment was done on the abstracts in the small data set for specific time period. However, due to limited number of articles having an abstract the full text was examined using text analytics. It can be seen that the maximum number of words in articles has been increasing over the years, with longest published in 2017 (4062 words). The average is 616 words over the whole time period. The number of articles published reached the highest in 2006 with noticeable decreasing trend after that year. Table 3 presents the number of news articles that has a specific subject term. It is important to note that an article can have more than one subject term and the number of articles in Table 3 does not represent a unique number of papers. For example, article A is counted in "Government News" and "Government – Central" and "United Kingdom" because it has all these subject terms.

Table 2. Summary of FT news articles.

Year	Num. of Titles	Num. of Abstracts	Num. of Full Text	Count of at least one 'subject terms' present	Max num. of words (title)	Max num. of words (full text)
1996	14		14	14	29	827
1997	24	10	24	24	24	1324
1998	18	18	18	18	42	1774
1999	11	11	11	11	35	1101
2000	20	20	20	20	47	895
2001	24	24	24	24	37	1703
2002	17	17	17	17	38	769
2003	30	30	30	4	43	1366
2004	29	29	29	1	42	2373
2005	31	31	31	1	30	1408
2006	44	44	44		41	2905
2007	18	18	18		22	1808
2008	24	24	24	1	11	2309
2009	15	15	15		9	1005
2010	28	28	28	1	11	1768
2011	23	12	23	3	10	2424
2012	20		20		11	1993
2013	16		16		9	2070
2014	17		17		11	2026
2015	18		18		12	1491
2016	10		10		11	2025

2017	21		21	21	12	4062
Total	472	331	472	160		

Table 3. Top subject terms.

Top Subject Terms (Classification)	Num. of articles	Top Subject Terms (Country)	Num. of articles
Government News	48	United Kingdom	62
Government - Central	38	Europe	55
Company News	30	European Economic Community/ EC	49
Foreign trade	28	European Union	46
Economic News	24	Western Europe	44
Politics	17	Turkey	18
International Affairs	13	United States—US	18
International relations	13	Mediterranean	17
Markets & market information	13	Asia	12
European Union Government	12	Japan	11
Contracts	11	East Europe	9

As can be seen in Figure 1 in combination with Table 3, the news coverage prior to 2014 mainly focused on government and European matters, with some articles linked to PFI, contracts, technology, corruption. It is linked to the scope of Financial Times that has a special emphasis on business and economic news.

In it notable that after 2015, the matters related to specific provisions, for example in local communities (e.g. schools, teachers, education) become more prominent in publications. It is also important to note that some academic discussions in relation to the public procurement over the last decade have limited visibility in news articles. For example, after further examination, words such as “sustainability” have only been mentioned in six articles; “SME/SMEs” in eight and “value for money” in twenty-seven. This exploratory study emphasises the importance of academia to engage further with periodic publications to bring these important discussions to the public.

The next step of the research is to finalise the theoretical framework related to public procurement academic literature and to link prominent academic topics to newspaper sources expanding on potential reasons and limitations when trying to link two diverse sources: academic papers and international daily newspaper. One potential reason for ‘mismatch’ can be linked to different type of language used in each domain, nevertheless some similarity we would expect to emerge during the analysis.

Figure 1. Visualisation (WordClouds) for different time periods.

1996-1999 (67 articles)

2000-2004 (120 articles)

2005-2009 (132 articles)

2010-2014 (104 articles)

2015-2017 (49 articles)

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A trend study of ecological product development partnerships in the German foundry value chain

Tobias Held and Thorsten Lammers

Prof. Dr. Tobias Held, University of Applied Sciences Hamburg, Berliner Tor 21, D-20099 Hamburg, Germany, tobias.held@haw-hamburg.de

Dr. Thorsten Lammers, University of Technology Sydney, PO Box 123, Broadway NSW 2007, Australia, thorsten.lammers@uts.edu.au

Abstract

Early supplier involvement in product development gained importance in the last decades due to higher technological complexity and increased outsourcing activities. This paper analyzes economic and ecological aspects of product development partnerships in the German foundry industry. The analysis is based on comprehensive surveys conducted in 2013 and 2017 covering supplier and customer integration issues and potentials at the interfaces of German casting houses and their customers. In general, the arrangement of cross-company product development collaborations seems rather stable. In a time of increasing environmental requirements, this lack of significant change opens a new field of analysis for increased sustainability.

Keywords: Product Development Partnership, Foundry Industry, Trend Study, Supplier Integration

Introduction

During the last decades, industrial companies were confronted with various challenges due to shorter technology and product lifecycles, increasing customer demands and higher environmental requirements (Cooper, 2011; Smith and Reinertsen, 1998; Ulrich and Eppinger, 2016). This is in particular valid for small and medium-sized companies (Clarke and Gershenson, 2007; Fiksel, 2009; Schewe and Becker, 2009). Especially, sustainability aspects are gaining more and more importance in this context (Bras, 2009; Brandenburg, Hahn and Rebs, 2018; Matsumoto et al., 2017; de Oliveira et al., 2016). Against the background of increasing worldwide demand for raw materials and energy, a sustainable use of resources in production processes is highly important. This requirements is particularly relevant for the energy-intensive casting industry (Institut für Gießereitechnik, 2013; Vieweg and Reinhard, 2009; Vieweg and Wanninger, 2010). As a result, it seems important to extend the research on how suppliers can be integrated by their customers during product (e.g. casting) development in a sustainable way (Eisto et al., 2010; Fandl and Held, 2018; Gualandris and Kalchschmidt, 2016). Environmental effects have not yet been a focus of research on early supplier integration for product development. Less than 3% of publications (17 out of 596) between 1985 and 2014 have considered sustainability aspects (Held, 2015b).

In addition to that, there have been calls to tackle the problems of one-off data collections by including more longitudinal data collection aspects in the field of early supplier integration (Wynstra, Corswant and Wetzels, 2003; Song and Parry, 1997; Petersen at al., 2008; Lawson and Potter, 2012; Hartley et al., 1997). Combining these considerations, this paper deepens the knowledge in this field by presenting a survey-based, longitudinal trend study on the impacts of ecological product development partnerships in the German foundry value chain.
This paper is structured as follows: after this introduction, the scope of this paper is grounded in existing academic literature. This is followed by an overview of the sample structure and the survey design of the trend study. Afterwards, the trend study results about the development of ecological product development partnerships in the German foundry value chain are presented. The paper finishes with a conclusion and outlook.

Literature overview

Several studies and surveys covering diverse industries confirm that many enterprises increasingly recognize the economic benefits of sustainable products and processes (cp. e.g. Abele, Anderl and Birkhofer, 2005; Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, 2002; Hundal 2002). Integration of suppliers in product development initiatives has long been established as being a strategically critical issue with significant impacts on performance improvements such as cycle time reductions, quality improvements and cost reductions (Birou and Fawcett, 1994; Ragatz, Handfield and Scannell, 1997). The positive relation between supplier relationship and environmental impact has been studied in both directions. Maxwell and van der Vorst (2003) found that reducing the environmental impact of product development can lead to improved supplier relationships through the ability to provide more sustainable offerings. On the other hand, environmental benefits can be achieved through a strengthened supplier relationship, which can for example lead to more efficient recycling and/or refurbishment processes (Tukker and Tischner, 2017). However, in order to drive sustainable competitive advantage, supplier integration cannot be static, but has to be interpreted on the basis of dynamic re-configurability (Vanpoucke, Vereecke and Wetzels, 2014). In order to achieve this, the alignment of strategic supplier portfolio selection and corporate sustainability targets can be the basis for development of an optimal strategic supplier portfolio (Neumueller, Lasch and Kellner, 2016). This has been studied and confirmed in cases such as for the fashion industry, where supplier integration and green sustainability programs were crucial performance factors (Li et al., 2016) and for the car industry, where sustainability in early product development stimulates supplier collaboration (Schoeggl, Baumgartner and Hofer, 2017).

Trend study overview – sample structure and survey design

Data collection generally followed the methods proposed by Dillman (2009). From the end of 2012 to the beginning of 2013, a first survey was conducted that covered supplier and customer integration issues at the interfaces of casting houses and their customers (Fandl, Held and Kersten, 2013; Held, 2015a). Sales, product development and management experts from all German iron and non-ferrous metal foundries were contacted for this comprehensive survey. In the middle of 2017, the survey was replicated using the same target group and

identical questions, with one exception - a question covering the advantages of involving suppliers in product development was slightly reformulated and used a different scale. Survey questions and scales have been inspired by and based on previous study designs in a similar context (Monczka et al., 2000; Primo and Amundson, 2002; Ragatz, Handfield and Scannell, 1997; McGinnis and Vallopra, 1999; McIvor and Humphreys, 2004). Survey responses have been checked for consistency and erroneous responses have been excluded from the analysis.

In the first and second survey periods, a total of 1,589 and 1,738 e-mail addresses were compiled respectively (cp. Gießerei Erfahrungsaustausch, 2015). Due to failed e-mail deliveries and companies no longer in existence, 1,156 and 1,467 potential participants were actually reached. From this pool of potential participants, 215 and then 122 completed and submitted the survey successfully after two follow-ups each time. This represents a response rate of 18.6% and 8.6% respectively. Non-response bias was checked (Armstrong and Overton, 1977; Lambert and Harrington, 1990) and is not a serious problem for this study. All participants of the first round were contacted again for the second round. However, due to anonymity requirements, the exact percentual overlap of identical respondents between the two studies could not be identified. Even though the response rate was substantially smaller in the follow-up survey, the coverage allows generalizations and a differentiated analysis. The lower percentage of participants might potentially be due to the fact that the German Casting association was not mentioned in the covering e-mail of the second survey. Also, filling out the same questions a second time might explain the unwillingness to take part. The lower attendance rate could also be an indication that environmental issues might be of lower importance to casting companies in 2017.

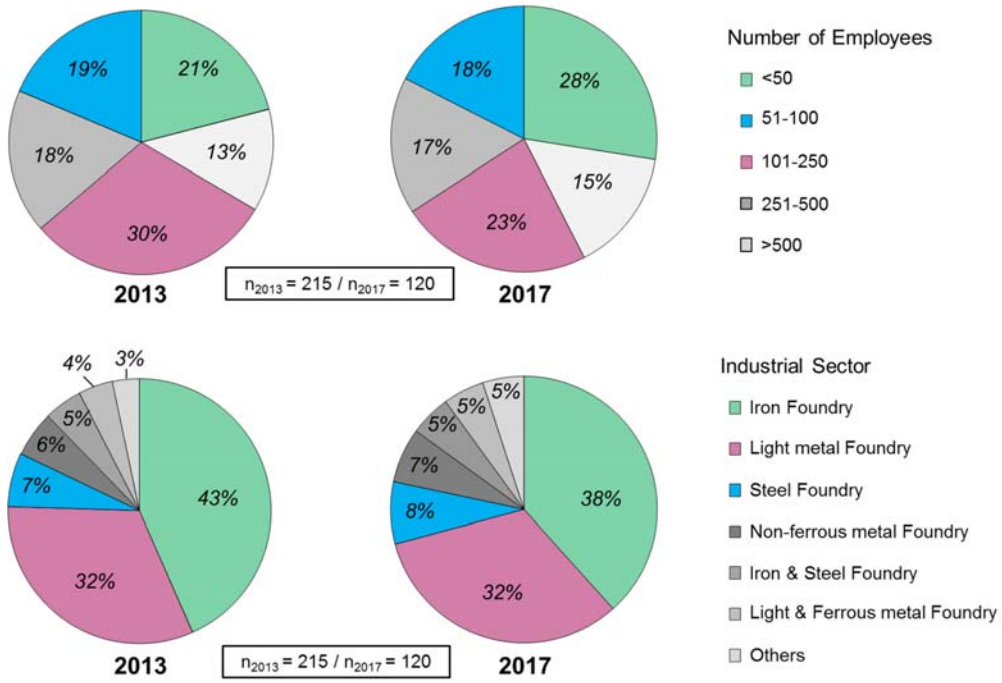

Figure 1: Distribution of the participants of the survey split by companies sizes (top) and casting materials (bottom)

Figure 1 provides the distribution of the participants according to the size of their companies (measured by the number of full-time employees) and according to the industrial sector they are in (based on the type of casting material they work with). On average, the company sizes of the participants of the second survey round tend to be slightly smaller. Iron foundries represent the largest category with approx. 40%, followed by the light metal foundries with a share of 32% and steel foundries with a share of 8%. However, several foundries use two or more casting materials. The samples can be regarded as representative of the German casting industry (Fandl, 2017; Statistica, 2017).

Figure 2 shows relevant certificates that were employed by the companies of the survey participants. More than 85% of the German casting companies are and have been certified by the DIN EN ISO 9001 standard. This standard is the foundation of further certification efforts of many companies in the foundry supply chain. This was followed by the environmental management standard DIN EN ISO 14001 with a share of 41% in 2013; there is a slight increase in the percentage of casting companies being certified by these two standards in the last years. Only 23% of the companies of the 2013 survey attained the DIN EN ISO 50001/DIN EN 16001 energy management certification. This percentage increased by more than 100%, so that more than four out of ten companies in the survey now achieved an energy management certification.

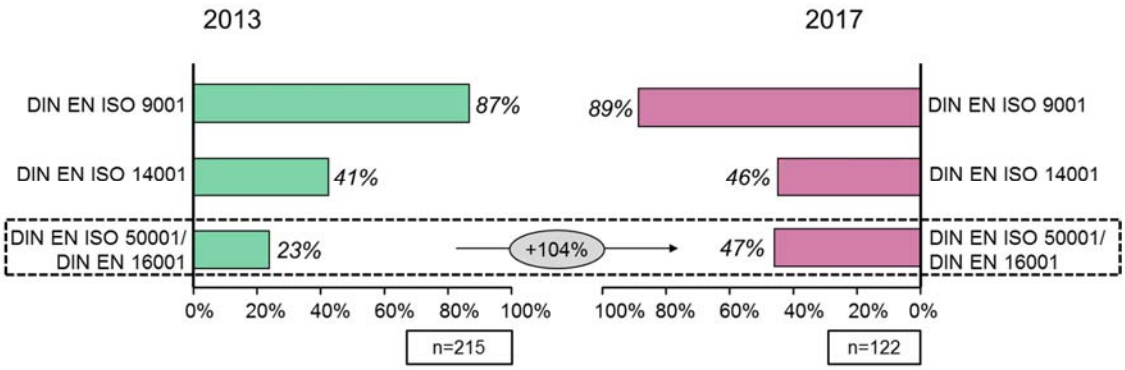

Figure 2: Certificates of German foundries (selection)

A more in-depth analysis reveals there is a strong correlation between the DIN EN ISO 50001/DIN EN 16001 certification and the size of a casting company. The percentage of companies that own this certificate decreases strongly with the size of the company: in 2013, DIN EN ISO 50001/DIN EN 16001 certifications were not present at all at any very small company (<50 employees). In 2017, about 20% of the companies with less than 50 full-time employees were already able to achieve an energy management certification. This increase in the percentage of ISO 50001 certified foundries is most likely based on the possibility of reimbursements of concession taxes by the German Renewable Energies Act, which has provided incentives to implement energy management certifications since 2013 (Reimann, 2017).

The previously described sample is used to gain an understanding of the need for collaborations and supplier integration for sustainable product development. The developed survey questionnaire is based on three core hypotheses that have been designed to cover the

key aspects of this research (potentials, level of integration and importance of environmental aspects) and that are supported by several sub-hypotheses (see Figure 3).

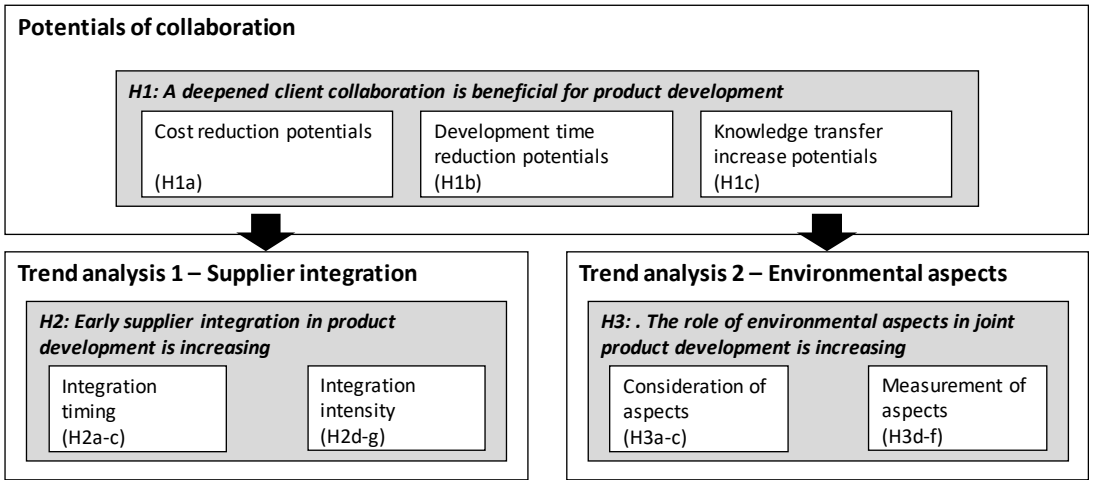

Figure 3: Structure of hypotheses

The sub-hypotheses directly relate to the survey questions:

1. Potentials of collaboration
   The first part investigates if there is a general understanding that client collaborations are beneficial for the development of new castings. Hypothesis 1: **A deepened client collaboration is perceived to be beneficial for casting development** (Monczka et al., 2000; Primo and Amundson, 2002; Ragatz, Handfield and Scannell, 1997). The hypothesis will be tested by looking at three potential collaboration benefits – cost reduction potentials, development time reduction potentials and the potential to increase knowledge transfers between collaboration partners. These three sub-hypotheses to test collaboration benefits have been linked to provide a comprehensive measure for collaboration potentials loosely following the triple constraint ("time", "cost", "performance") as a measure for success (Kerzner, 2010).

2. Trend analysis 1: Supplier integration
   The first part of the trend analysis looks at how the integration of suppliers has changed between 2013 and 2017. Hypothesis 2: **Early supplier integration/involvement of casting companies in product development is increasing.** This hypothesis has been frequently devised for many years for numerous industries (cp. e.g. Dombrowski and Karl, 2016; Handfield et al., 1999; Held, 2010, 2015b; Hoegl and Wagner, 2005; Johnsen, 2009; Petersen, Handfield and Ragatz, 2003; van Echtelt, 2004, Wagner, 2010). It will be tested by looking at the intensity and point in time of supplier integration (McGinnis and Vallopra, 1999; McIvor and Humphreys, 2004; Petersen, Handfield and Ragatz, 2005).

3. Trend analysis 2: Environmental aspects
   The second part of the trend analysis looks at how the role of environmental aspects has changed between 2013 and 2017. Hypothesis 3: **The role of environmental aspects in joint product development is increasing.** This hypothesis is also stated many times

across different industries (cp. e.g. Clarke and Gershenson, 2007, S. 70; Fandl, Held and Kersten, 2014; Giudice, La Rosa and Risitano, 2006; McDonough and Braungart, 2006, S. 39). It will be tested by looking at how strongly environmental aspects are considered and how much respective data for their measurement is provided to customers (Bras, 1997; Mackenzie, 1991; McDonough and Braungart, 2006).

To analyze the core hypotheses, several sub-hypotheses were formed (see Table 1). These hypotheses were reformulated as statements or questions and, after discussing them inside the research team, they were tested with a convenience sample of 10 casting experts from industry for content validity by evaluating whether the scale items adequately represented the construct domain (DeVellis, 2017). The experts reviewed the questions posed in the survey, evaluating concept and instruction clarity, ambiguity and readability. After modifications, the questions were finally included in the surveys.

H1. A deepened client collaboration is perceived beneficial for casting development		
Cost	H1a	Deepened collaboration has the potential to lower development costs
Development time	H1b	Deepened collaboration has the potential to lower development time
Knowledge transfer	H1c	Foundries have higher know-how concerning optimized casting development than their customers
H2. Early supplier integration/involvement of casting companies in product development is increasing		
Integration timing	H2a	Foundries are integrated increasingly in the idea/concept phase
	H2b	Foundries are integrated increasingly in the design phase
	H2c	Foundries are integrated increasingly in the test phase
Integration intensity	H2d	Foundries are more aware of the development processes of their customers
	H2e	Customers are more aware of the development processes of their foundry suppliers
	H2f	There are more regular mutual adjustment processes during product development
	H2g	More cross-company development teams were used during product development
H3. The role of environmental aspects in joint product development is increasing		
Consideration of aspects	H3a	Ecological aspects are increasingly considered during joint product development
	H3b	Foundries know more about ecological aspects during joint product development
	H3c	Customers expect more key performance indicators about ecological aspects during product development
Measurement and communication of environmental KPIs	H3d	Foundries provide more data about energy consumption of castings during joint product development
	H3e	Foundries provide more data about CO_2-emissions of castings during joint product development
	H3f	Foundries provide more data about water consumption of castings during joint product development

Table 1: List of hypotheses used as basis for the surveys

Trend study results – The development of ecological product development partnerships in the German foundry value chain

This part of the paper shows and discusses the results of the trend study survey. This is done by analyzing each sub-hypothesis and consolidating the results in order to test the main hypotheses.

Potentials of increased customer collaboration

The first hypothesis "H1 – A deepened client collaboration is perceived as beneficial for product development" is tested by analyzing its three sub-hypotheses: Regarding H1a and H1b, results show that a relative majority of respondents see a potential of 7-15% to improve development time and costs of new products through a deepened collaboration with their clients (see Figure 4). Even though the results for development time and costs follow the same pattern, a stronger potential for the reduction of development time can be observed – a 55% higher feedback on an improvement of 30% or more and a 47% lower feedback on an improvement of 1% or less. (Please note that the questions regarding hypotheses H1a and H1b were asked in the 2013 survey with a different scale, so no direct comparison can be provided here). Interestingly, respondents from "successful" companies (with an increase in market share) rated the development time and cost-saving potentials (significantly) higher than respondents from "unsuccessful" companies (with decreasing market shares). Conducting further bivariate ("rank correlation") analysis detected no differences between e.g. casting companies of different sizes or dissimilarities between casting houses with different customer industries.

H1a – "Deepened collaboration has the potential to lower development costs"
H1b – "Deepened collaboration has the potential to lower development time"

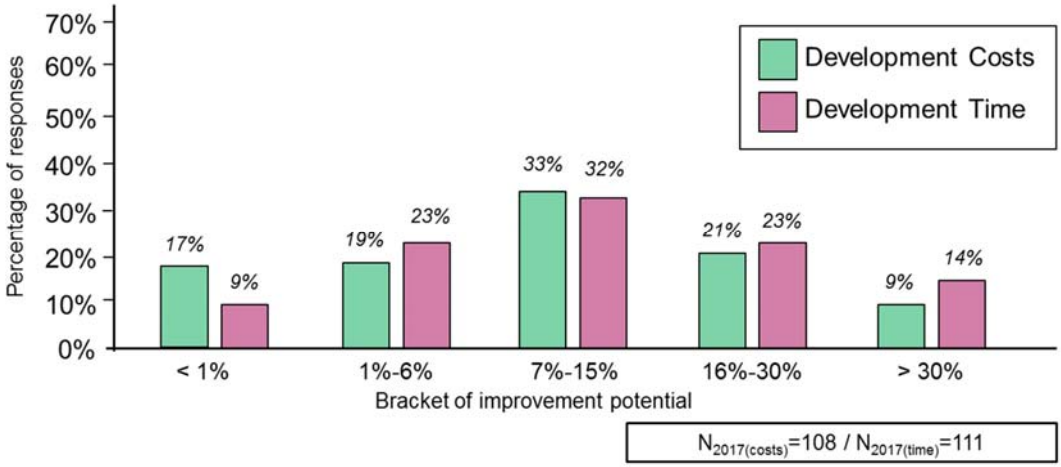

Figure 4: Potentials of increased customer collaboration (1/2) (Hypotheses H1a-b)

The respondents were also asked about their knowledge advantage compared to their clients in the area of product development (see Figure 5; cp. Hölttä, Eisto and Mahlamäki, 2009; Saarelainen et al., 2008). A similar percentage of respondents agreed to this statement in 2013 and 2017. Having superior know-how should enable improvement potentials that could not be realized by product development by customers alone (Brewer and Arnette, 2017; Fandl, Held and Kersten, 2014). This confirms potential advantages of deepened foundry integration in product development. Interestingly, this conclusion was also observed by another empirical study in 2013 in which more than 70% of machine tool manufacturers agreed to the statement that their foundry suppliers had predominant know-how in the development of casting products (Fandl, Held and Kersten, 2013; Held, 2015a).

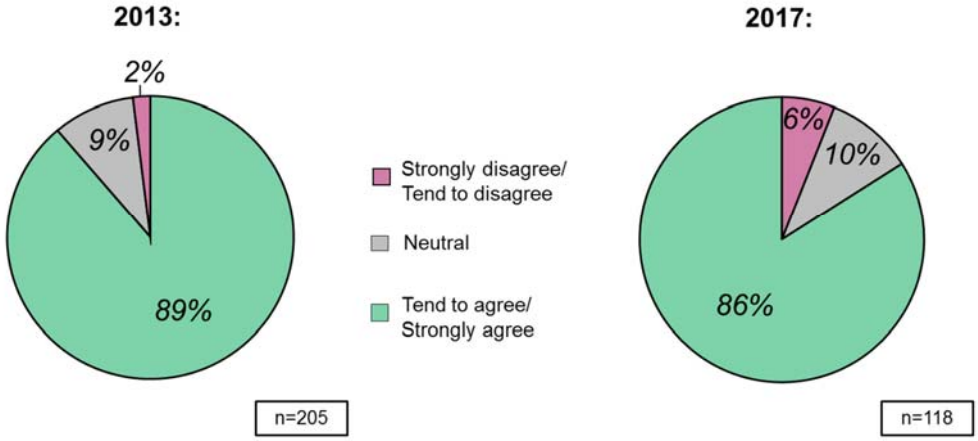

Figure 5: Potentials of increased customer collaboration (2/2) (Hypothesis H1c)

Based on the results in this section, it can be confirmed that the respondents deem a deepened client collaboration beneficial for a more successful product development as it will have positive impacts on development costs, development times as well as an increased synchronization of knowledge.

Having confirmed the hypothesis that "A deepened client collaboration is perceived beneficial for product development", the next two sections will look at how this translates into increased supplier integration (H2) and the increasing role of environmental aspects in joint product development processes (H3).

Trends in early supplier integration/involvement of casting companies in product development

Considering the previously discussed perceived benefits of deepened client collaboration, this section examines the potential trend of increased casting supplier integration over the last four years. The hypothesis "H2 – Early supplier integration in product development is increasing" will be analyzed based on a comparison of survey results from 2013 and 2017. The tests´ sub-hypotheses are grouped into integration timing and integration intensity as fundamental parameters for supplier integration (Handfield et al., 1999; Monczka et al., 2000; van Echtelt and Wynstra, 2001; Wagner, 2003; for the fuzzy front end cp. Schoenherr and Wagner, 2016).

Hence, the first important aspect of examining trends in early supplier integration and cross-company cooperation in product development projects is the integration timing. The surveys explore three main phases of the product development process – idea or concept, design and testing (Jayaram, 2008; Song and Di Benedetto, 2008; data about the production phase was also collected, but will not be presented here). The 2013 survey shows that about half of the participating foundries collaborated with "no or very few (<5%) customers" at an early development stage (during the idea or concept phase) (see Figure 6). Only about one-fifth of the foundries could already integrate more than 25% of their customers in this early phase when most degrees of freedom exist. Only minor or insignificant changes seem to have taken

place since the first survey (rejection of H2a; Chi-squared test with four degrees of freedom and p=0.05). During the design phase, even a (insignificant) slight decrease in the integration of castings suppliers in product development was detected (rejection of H2b). Concerning the integration of casting suppliers in the test phase, also no major or significant increase could be found in the survey data (rejection of H2c; Chi-squared test with four degrees of freedom and p=0.05). As a result, an increase in supplier integration regarding the timing of the different stages of the product development process cannot be confirmed for German foundry value chains. This result is further supported by a more differentiated subsample analysis of casting companies of different sizes and casting houses with different customer industries.

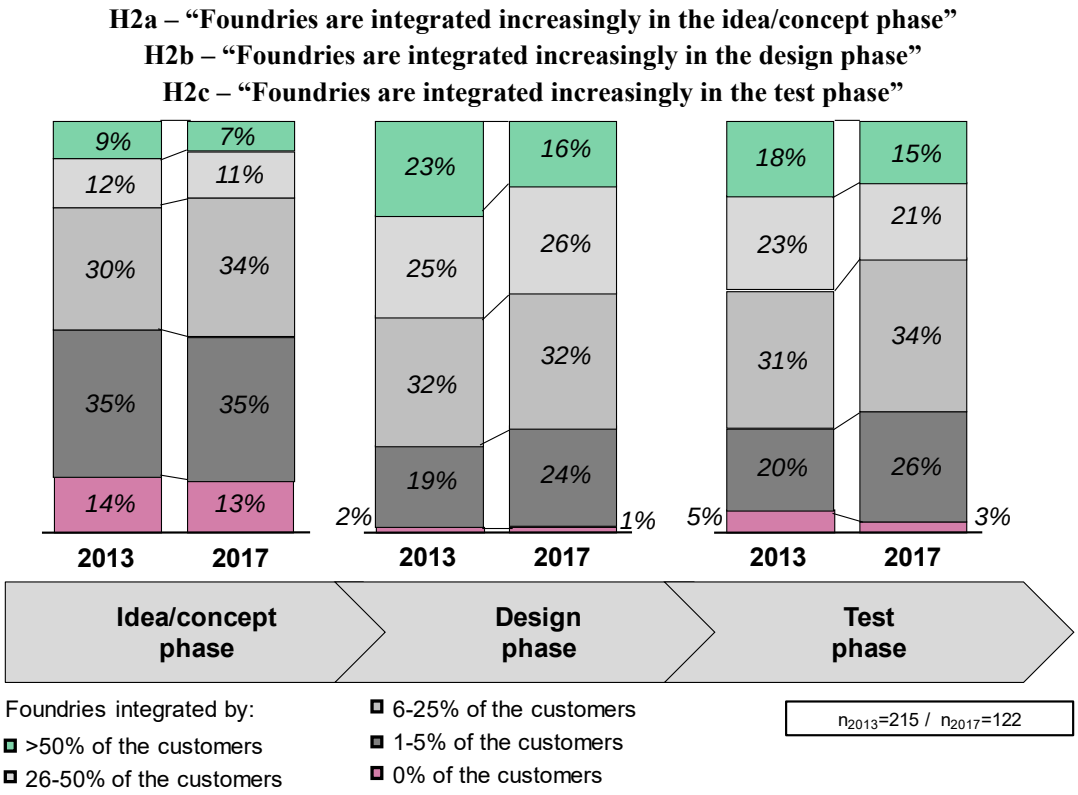

Figure 6: Trends in integration timing (Hypotheses H2a-c)

The second aspect of examining trends in early supplier integration and cross-company cooperation in product development projects is the integration intensity. This aspect is covered by four sub-hypotheses – two on mutual knowledge about product development processes between partners and two on coordination and cross-company team usage between suppliers and customers.

The results of the surveys concerning hypotheses H2d and H2e can be seen in Figure 7. No significant differences could be found concerning the knowledge of the casting suppliers about their customers' product development processes (rejection of H2d; Chi-squared test with four degrees of freedom and p=0.05). A slight improvement concerning the knowledge that customers have about the suppliers' product development processes was found. A share of responses has moved one bracket (1-5% to 6-25%). However, this shift did not disseminate through to the higher brackets of 26% and above (Chi-squared test acceptance of H2e with four degrees of freedom only at p=0.15).

H2d – "Foundries are more aware of the development processes of their customers"
H2e – "Customers are more aware of the development processes of their foundry suppliers"

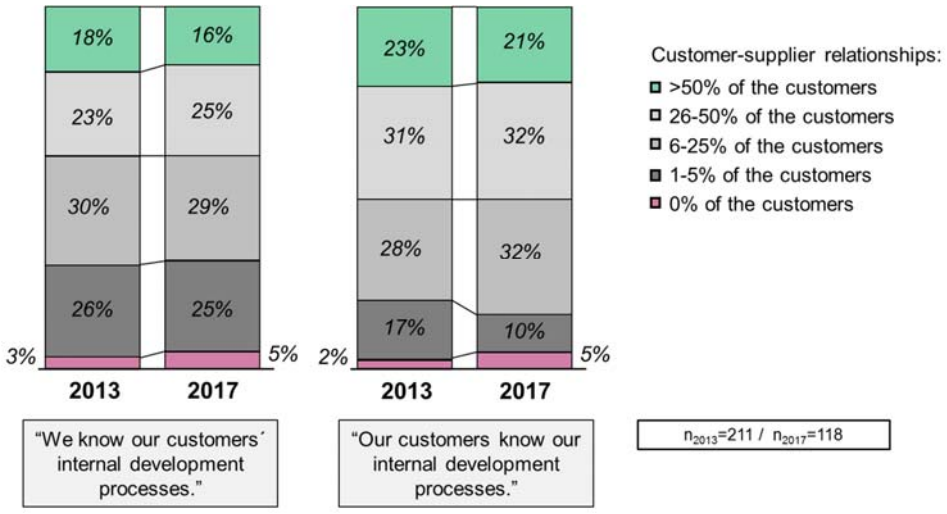

Figure 7: Integration intensity – knowledge about product development processes of partners (Hypotheses H2d-e)

Figure 8 shows the results with regards to the Hypotheses H2f and H2g. It could be found that mutual coordination activites during the product development process have sightly increased and now occur for a higher share of customers – 83% of respondents conduct mutual coordination activities with more than 5% of their customers compared to only 76% in 2013 (acceptance of H2e: Chi-squared test with four degrees of freedom and p=0.05). An even more specific coordination activity is the formation of cross-company teams for product development (Beckmann, Hoegl and Cordery, 2015; Potter and Lawson, 2013). The percentage of cross-company development teams used has increased slightly – only 34% of respondents are not using cross-company teams with any of their clients in 2017 compared to 39% in 2013. However, no significant overall increase of cross-company team usage was found (rejection of H2g; Chi-squared test with four degrees of freedom and p=0.05).

H2e – "There are more regular mutual adjustment processes during product development"
H2f – "More cross-company development teams were used during product development"

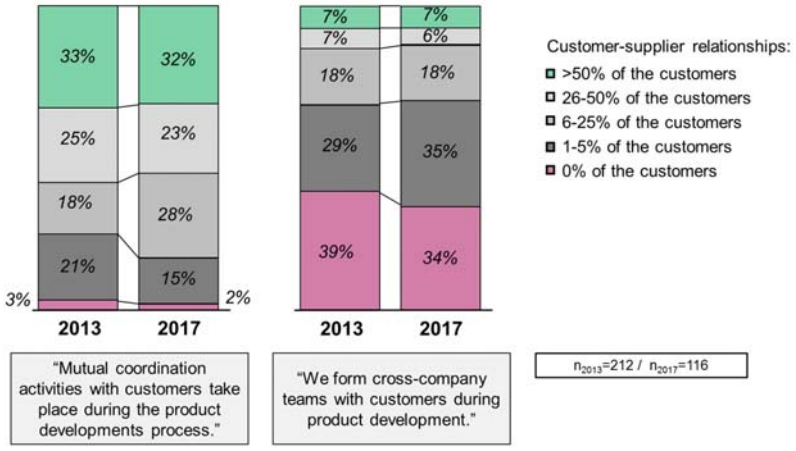

Figure 8: Integration intensity – Coordination and cross-company team usage (Hypotheses H2f-g)

Summing up, no substantial changes concerning timing or depth of supplier integration during product development in the German casting industry seem to have happened in the last four years. The arrangement of relationships and design partnerships appear rather unchanged.

Trends in environmental aspects in product development partnerships

Increased requirements to consider ecological aspects of casting products (should) play an important role in collaborative efforts of product development (Fandl 2017; Wagner and Enzler, 2006). The following section will therefore specifically investigate a potential increase in the importance of environmental aspects during joint product development efforts based on the 2013 and 2017 survey results (cp. Alting, Hausschild and Wenzel, 2007; Fritzgerald et al., 2007; Myer et al., 2007). The hypothesis "H3 – The role of environmental aspects in joint product development is increasing" will be tested based on its sub-hypotheses grouped into the generic consideration of environmental aspects and the specific measurement and sharing of environmental KPIs (Fandl, Held and Kersten, 2013; Held, 2015a; Walton, Handfield and Melnyk, 1998).

Regarding trends in the consideration of environmental aspects, the surveys explored three related aspects (Figure 9). There is a slight upward trend in the number of respondents who (partially) agreed that ecological aspects are considered during the development of casting products (up 19%). Surprisingly, the other end of the spectrum also sees an increase – 15% more respondents (partially) disagreed with the same statement. Thesis H3a is rejected (Chi-squared test with four degrees a freedom and p=0.05).

H3a – "Ecological aspects are increasingly considered during joint product development"
H3b – "Foundries know more about ecological aspects during joint product development"
H3c – "Customers expect more key performance indicators about ecological aspects during product development"

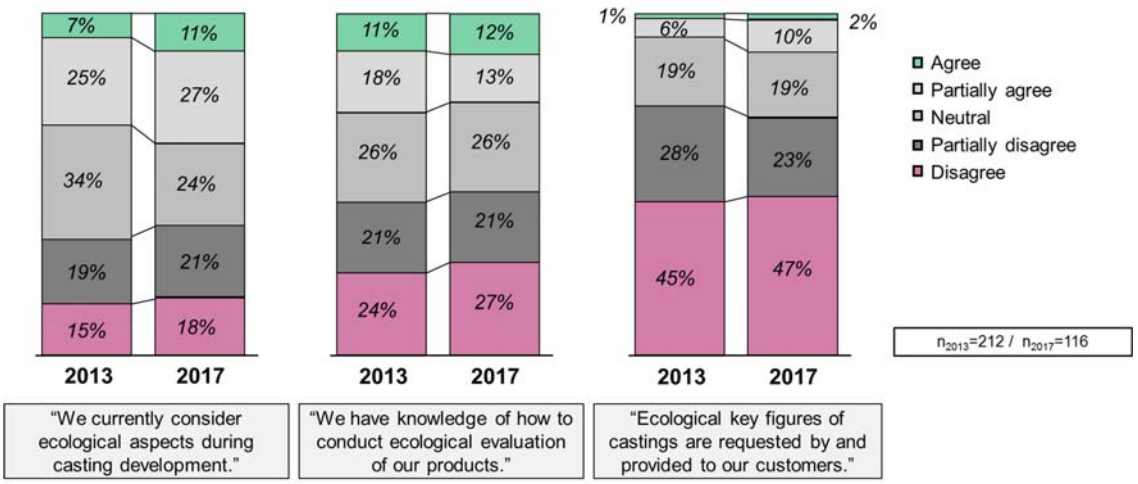

Figure 9: Consideration of environmental aspects in product development (Hypotheses H3a-c)

Consideration of ecological aspects is linked to the knowledge of how to evaluate ecological performance of one's products. Surprisingly, the survey results indicate that this knowledge seems to have decreased in the perception of the participants over the last four years – a 14% decrease in (partial) agreement and a 7% increase in (partial) disagreement. Hence, a (insignificantly) downward trend can be observed (rejection of H3b with Chi-squared test with four degrees a freedom and p=0.05). This observation is contrasted by an increased demand of ecological key figures by the customers – 71% higher (partial) agreement in 2017 compared to 2013 (from 7% to 12%). However, overall, only few customers seem to request ecological data from their casting suppliers during product development. Just 12% of the casting suppliers said they would have to provide ecological data in 2017 compared to 70% which did (partially) not provide such information (rejection of H3c; Chi-squared test with four degrees a freedom and p=0.05).

The second group of sub-hypotheses deals with trends in the measurement and communication of environmental KPIs between foundries and their customers. For this, the fundamental KPIs "Energy consumption", "CO_2-emissions", and "Water consumption" are highlighted here (see Figure 10). These KPIs are regarded to be of high importance in the casting industry and have been focused on for a long time (Lownie, 1978; Robison, 2011; Wagner and Enzler, 2006). Firstly, it is worth noting, that the overall communication of these KPIs to customers lies well below half of all respondents: most customers expect no statements or key performance indicators concerning environmental (energy, CO_2, water) aspects from their casting suppliers. In addition, the reported communication of CO_2-emissions has even decreased by 9% (rejection of H3e). However, communication of "Energy consumption" and "Water consumption" data has increased (by 15% and 46% respectively) (acceptance of H3f with Chi-squared test with one degree a freedom only at p=0.10; rejection of H3e with Chi-squared test with one degree a freedom and p=0.05). While only 32% of respondents from "unsuccessful" companies (with a decrease in market share) provided energy data to customers, more than 51% of the respondents from "successful" companies (with increasing market shares) did so.

H3d – "Foundries provide more data about energy consumption of castings during joint product development"

H3e – "Foundries provide more data about CO_2-emissions of castings during joint product development"

H3f – "Foundries provide more data about water consumption of castings during joint product development"

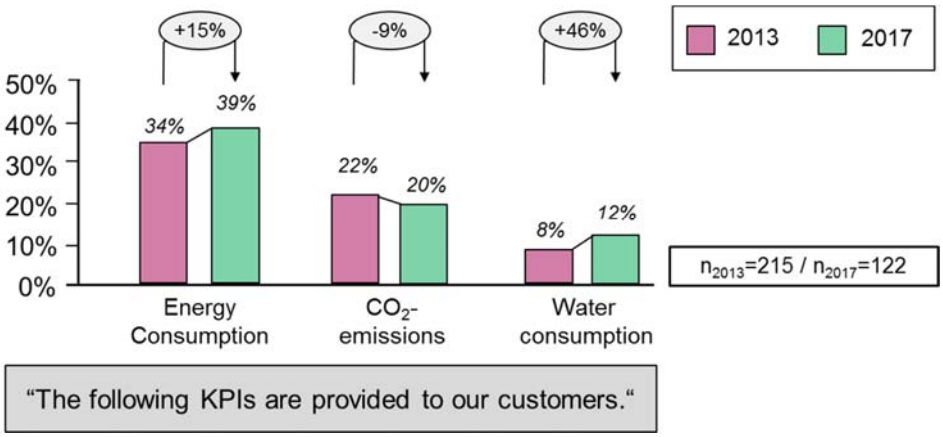

Figure 10: Measurement and communication of environmental KPIs (Hypotheses H3d-f)

In summary, it has to be deduced from the surveys that the importance of environmental aspects in joint product development activities has mixed results and has only marginally increased in the last four years.

Conclusion and outlook

Product development partnerships between foundries and their customers seem to take different shapes and depths in German foundry value chains. A promising starting point for optimization of product development constitutes intensive and early integration of customers and suppliers. According to the feedback from respondents, there are considerable improvement potentials, such as reduction of development times and development costs as well as improvement of production costs, casting functionalities and weight (the last three perspectives were also examined in this study, but not presented in this paper). More than three-quarters of respondents agreed with the statement that intensive integration of foundries during casting development could help realize optimization potentials. However, the hypothesis of a trend towards increasing integration of casting suppliers in product development activities could only be confirmed partially. The hypothesis of a trend towards more consideration of ecological aspects in joint new product development could also only be supported to some extent by the survey data analyzed. Figure 11 shows that the predicted increase in importance of environmental aspects did not realize as expected. Ecological aspects are considered by the majority of respondents with most consideration spent on energy consumption and CO_2-emissions; but the importance of joint product development is assessed lower than improvements in the production area[1] with one reason being that (still) only a limited percentage of customers ask for environmental KPIs.

[1] According to the results of the surveys, most methods for process improvement regarding ecological aspects are related to the *production* area and less to joint *development* activities. E.g. an evaluation of collected free texts identified the following areas with most foundry projects: introductions of energy management systems, heat recovery procedures and investment in more efficient furnaces and exhaust systems.

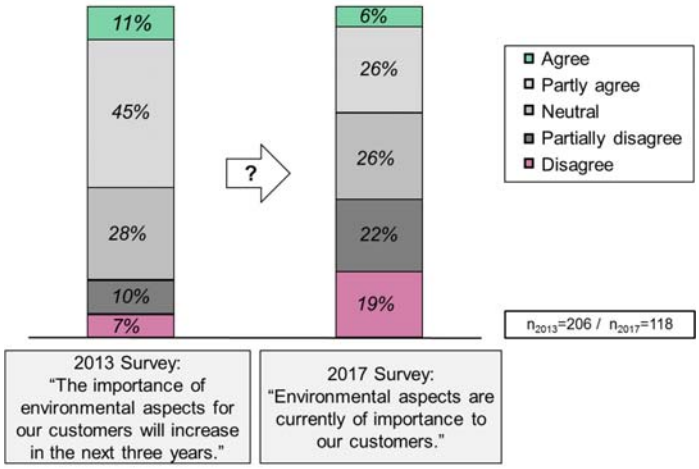

Figure 11: Importance of environmental aspects – prediction vs. actual progress

In summary, from this empirical survey it could be derived that the relationships between German casting suppliers and their customers have not undergone a radical change in the last four years: early supplier involvement has neither been altered significantly nor has the consideration of environmental aspects in joint product development increased considerably as a whole.

The outcomes of this research contribute to existing literature by investigating the impacts of early supplier integration in product development activities on sustainability. For this, the case of the German foundry industry was chosen. The high energy consumption of casting and Germany's position in the TOP 5 casting producing countries worldwide with very high productivity and quality levels make this an example of high relevance (American Foundry Society, 2018; FolkGroup, 2015). Compared to - for example - the electronics or the automotive industries, the foundry industry supplies products to a larger variety of industrial sectors, which further supports the selection of this industry as a case. In addition to that, Germany is known for its leading role in sustainable development, making insights into the perception of sustainability effects of supplier collaboration in product development projects a promising source of knowledge for research on this topic in other industries or countries (Buehler et al., 2011; OECD, 2018). Transfer potentials are considered to be highest to industries with similar values in the core parameters of the case such as size of energy footprint, importance of product development activities and complexity of supplier networks. The German automotive supplier industry, in which complementary studies regarding green supplier integrations have been conducted, seems like an obvious candidate (Caniels, Gehrsitz and Semeijn, 2013).

The results show that realizing the improvement potential through stronger supplier integration does not lead to significant initiatives trying to execute this. This is surprising, especially considering the big impact potentials due to the industry's high energy footprint. Future research could hence therefore look into:

a) What internal roadblocks hinder execution of supplier integration activities despite the knowledge of its potential, and

b) How might changes to regulatory frameworks and incentive systems help leverage these potentials?

Acknowledgements
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BUYERS BETTER BE SOCIAL

JOB-RELATED SOCIAL MEDIA USE AS ENABLER FOR CREATIVITY IN PROCUREMENT

Jonas Heller[1], Frank Rozemeijer[2] and Lieven Quintens[2]
1 The University of New South Wales, Australia
2 Maastricht University, The Netherlands

1. INTRODUCTION

In recent years, the continuous development of social technologies has changed the way how people connect and communicate, seek and share information and acquire new knowledge (Hanson, 2007). The use of social media platforms - such as social networking sites, blogs, wikis or other content-sharing websites - is growing at an increasing pace. Social media has revolutionized the lives of nearly every person on this planet, given that of the 3.7 billion people with access to the internet in 2017, more than 70% are active social media users (Statista, 2017). Compared to 2015, active social media use grew by 10% (Chaffey, 2016). From a marketing point of view, various scholars have researched how to use social media platforms to support (industrial) marketing and sales performance (Pratyush et al., 2015; Stephen and Galak, 2012; Woodcock et al., 2011). However, insights from the other side of the buyer-supplier dyad are much scarcer. Based on a large number of blogs that discuss the potential contribution of social media in procurement (Albert, 2010; Barnato, 2011; Busch, 2011; Evans, 2011; Handfield, 2011; Ranson, 2011), it is expected that the use of social media can also lead to improved connectivity among procurement professionals as well as positively affect their performance by allowing for more creativity in their daily tasks. Information, networks, and relationships are crucial for procurement professionals to solve everyday challenges (Dion et al., 1995; Kiratli et al., 2016; Rozemeijer et al., 2012; Smith, 1998). A combination of active and passive use of social media could enable these procurement professionals to efficiently network with their peers, internal stakeholders, business partners and potential suppliers and facilitate creative problem-solving.

However, although procurement professionals think that social media has the potential to support them in their daily job, many of them do not use it to its fullest potential (Rozemeijer et al. (2011). Knowledge on social media's impact on procurement professional's creativity or on how it alters their task routines at the job is limited (Tsay et al., 2012) and empirical research present today focuses on particular and small samples (Cao et al., 2012). Some research even suggests that social media is considered as a security trap for companies (Turban et al., 2011). Consequently, some company policies are blocking social media use in the workplace and tend to be reluctant to exploit the positive sides of it.

Social media enables receiving and spreading information across the globe between individual that have potentially never personally met, thus cues that people traditionally use to determine trustworthiness of information and whether to share information with someone else are somewhat obsolete in social media environments (Flanagin and Metzger, 2013). We have learned from previous research that social media self-efficacy, a concept based on Bandura's (1997) self-efficacy theory, is one of the primary drivers for private social media use and how information received or transferred via social media are evaluated or trusted (Hocevar et al., 2014). Yet, we know little about the role of social-media self-efficacy and collective-efficacy in procurement work environments.

As companies are driven by competitive pressures, sourcing strategists are trying to establish creative ways of securing supply value, reducing supply risk as well as lowering long-term

supply costs (Kiratli et al., 2016). The creativity of individual procurement professionals relies on the strength of their networks as well as on in-depth knowledge of their supply markets and supply chains to be able to creatively exploit opportunities (O'Toole and Donaldson, 2002; Wang and Archer, 2007). Barnato (2011) stated that "[…] procurement professionals should be proactive in their use of social media as it is an excellent source of free supply market intelligence and those who refuse to engage may be significantly disadvantaged in the long term". According to the IDC report of 2014, buyers highly value trust in their supply chains/networks and could increase trust with potential suppliers using social media. However, contrary to what we might expect, research on job-related use of social media by procurement professionals and the potential impact on their creative ability is mostly absent. Therefore, this study aims to empirically investigate the effect job-related social media use can have on the creativity of individual procurement professionals.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Job-related Social Media use

Several studies have investigated why and how much people use social media in a private context, including its effect on creativity and collaboration (Alahuhta et al., 2014; Dabbagh and Kitsantas, 2012; O'Keeffe and Clarke-Pearson, 2011; Peppler and Solomou, 2011). Job-related social media use, however, is barely researched. Recent literature takes two different perspectives and either focuses on the potential downsides such as individual psychological stressors, security lacks or distraction from work tasks (Appel et al., 2016; Fox and Moreland, 2015; Hildebrand et al., 2013), or highlights the positive aspects as network creation and increased motivation (Cao et al., 2012; Leftheriotis and Giannakos, 2014; Turban et al., 2011).

In line with Leftheriotis and Giannakos (2014) and Cao et al. (2012), it is crucial to distinguish between social media use for private purposes, such as maintaining a private network to stay connected with friends, family, and job-related use of social media. The latter describes the use of social media to execute a particular task or reach a certain goal related to the job responsibilities of an individual. Typical examples are marketers using social media to promote a product, business analysts looking for trends in certain industries by analysing blogs or social networking sites, or recruiters using public professional networks such as LinkedIn or Xing to screen potential job candidates (Nagendra, 2014; Steyn et al., 2010).

The job-related use of social media has been associated with a positive impact on performance of both individual workers and organizations (Leftheriotis and Giannakos, 2014). Charoensukmongkol (2014) found a positive relationship between co-worker support, job-demand, and social media use. These findings support a connection between the job-related use of social media and organizational performance (Tassabehji and Moorhouse, 2008). Interpersonal communication skills are crucial for procurement professionals and identified by several scholars as necessary part of their primary skillset (Carr and Smeltzer, 1997; Erridge and Greer, 2002; Walker et al., 2000). Next to the need to network to perform the job effectively, procurement professionals need to stay up-to-date on industry trends, understand changes in the supply market and learn more about the goods and services to procure (Giunipero and Pearcy, 2000). Using and interpreting this information to an advantage are additional skills which are indispensable for procurement professionals to perform well on an individual level (Luo et al., 2009; Tassabehji and Moorhouse, 2008).

The individual creative ability of each member of a procurement team is a significant element of the purchasing department's contribution to the corporate success (Feisel et al., 2011; Giunipero and Pearcy, 2000; Kiratli et al., 2016; Tassabehji and Moorhouse, 2008). Hence there is a growing interest to understand whether job-related social media use impacts individual creativity in the procurement environment. Creativity is generally defined as the development of new, original and, useful ideas that lead to an improvement or solution of a given situation

that are not just theoretical in nature but can be transformed into practical actions (Amabile et al., 1996). In a procurement context, the creative ability of the individual manager is therefore crucial when developing innovative ideas for sourcing and buyer-supplier relationship management. Challenged by small margins in procurement budgets and the movement away from simple cost-cutting strategies towards sustainable long-term buyers supplier relationships, procurement professionals are forced to network efficiently to maximize potential information exchange that fosters creative solutions (Kiratli et al., 2016).

Conceptually, job-related social media use can be divided in "active" and "passive" social media use, as there are significant differences between these types of social media use (Pagani et al., 2011). Active use of social media refers to producing, reproducing, or sharing social media content of any kind. Passive use of social media describes the consumption of content, hence reading or viewing content created or shared by others on social media platforms (e.g., Twitter, Facebook, LinkedIn, Xing). It is essential to make a distinction between these two concepts for two reasons. First, from an exploratory perspective, it is imperative to conceptually differentiate between these two constructs as antecedents and outcomes of job-related social media use are still unknown (Pagani et al., 2011). Second, from a managerial standpoint, active and passive use differ regarding the time employees spend using them. Also, differences in outcomes are expected. Active use of social media, for example, communicating with suppliers, peers or competitors, can, if not executed correctly, lead to adverse outcomes such as reduced supplier- as well as buyer-performance (Paulraj et al., 2008). Hence, companies and academics are interested in understanding what type of social media use benefits their procurement professionals (Leftheriotis and Giannakos, 2014).

Social media self-efficacy

The use of job-related social media platforms depends on the access to the Internet and web-enabled devices, individual skills, and personality. Previous research shows, that more outgoing persons are more likely to make use of social media (Amichai-Hamburger and Vinitzky, 2010; Correa et al., 2010). Also, the extent to which the skill set of an individual enables quick adoption and effective use of new technology seems to be an essential factor, as could be observed at previously introduced new technologies (Agarwal et al., 2000; Bandura, 1993). Research shows that the more computer self-efficacious individuals are, the more likely they are to use computers (Durndell and Haag, 2002). Self-efficacy is defined as the individual's belief in his/her ability to structure, organize and execute a certain task or activity (Bandura, 1982). In the context of social media, self-efficacy describes the individual's belief in his/her ability to participate both actively and passively on social media platforms. The theory of self-efficacy implies that the more often individuals are using social media platforms, the more self-efficacious they become and the higher their expectations of potential outcomes (Hocevar et al., 2014). Thus, the more often procurement professionals use social media, the higher the likelihood of future use (Bright et al., 2015; Eastin and LaRose, 2000). Recently, Hocevar et al. (2014) introduced the concept of social media self-efficacy and defined it as "[…] a person's beliefs about his or her capabilities to perform desired functions specifically in the social media environment." The study concluded that the higher the social media self-efficacy of an individual is, the more likely it is that this person trusts the information gathered on social media and uses this information to expand individual knowledge. Based on the findings of the previous studies, we hypothesize the following:

Hypothesis 1 a + b: Social media self-efficacy of procurement professionals has a positive and direct impact on their active (1a) and passive (1b) social media use.

Collective social media efficacy

Procurement strategies for today's organizations are seldom developed by only one person but more often by teams of (procurement) professionals who work closely together (Giunipero et

al., 2005). It is therefore essential to consider not only the individual's belief in its own abilities, but also the belief in the ability of direct colleagues in the procurement department. We endorse Bandura (1986), who highlights the independence of self-efficacy beliefs and outcomes expectancies in groups and apply Riggs et al. (1994) definition of collective efficacy to social media use in procurement organizations. According to Riggs et al. (1994), collective efficacy refers to an individual's assessment of their colleagues' collective ability to perform job-related behaviours. People's beliefs in the collective efficacy of their team's ability to perform or execute a certain task, such as using job-related social media, influence the individual's behaviour and group's performance (Gibson et al., 2000; Gully et al., 2002) and result in an individual change of behaviour. Hence, if a procurement professional beliefs that a team is performing well in utilizing social media for job-related tasks, the individual might engage more in social media use as well. We therefore hypothesize:

Hypothesis 2 a + b: Collective Social media efficacy of procurement professionals has a positive and direct impact on their active (2a) and passive (2b) job-related social media use.

Creativity

For procurement professionals, fostering creativity has become a necessity, instead of an option, for being able to successfully compete in today's turbulent market environments (Rozemeijer et al., 2012; Shalley and Gilson, 2004). Following Csikszentmihalyi (1996), we view creativity as a combined system of individuals, knowledge domains and experts, revealing that creativity is more than individual efforts but rather a result of social interaction processes. A more recent social identity perspective by Haslam et al. (2013) explains the importance of teams and their social relationships as antecedents for individual creativity. Social relationships are important for collecting innovative ideas from peers, as well as generating new ideas based on knowledge and information acquired from others. Network theory takes a similar perspective in suggesting that the position of a person within a network can give that person access to information that can be used for task-relevant knowledge development as well as fostering job-related creativity (Perry-Smith and Shalley, 2003; Shalley and Perry-Smith, 2008). Previous research has shown that creativity has a positive impact on job performance outcomes of both individual procurement professionals and sourcing teams, making it relevant to develop a deeper understanding of how creativity can be fostered in the procurement context (Hargadon and Bechky, 2006; Hargadon and Sutton, 1997; Zhou and Shalley, 2011). On the individual level, this implies that procurement professionals could benefit from using social media for job-related tasks to enhance their creativity.

Hypothesis 3 a + b: Active (3a) and passive (3b) Job-related social media use has a positive and direct impact on creativity

Connectivity

We introduce connectivity, defined as being closely connected with your internal colleagues and stakeholders, as a mediator between social media use and creativity in the procurement context. Rozemeijer et al. (2012) stated that procurement professionals "[…] spend a significant amount of their time developing their social networks (i.e., internal stakeholders, partners, and customers) and engaging with them to develop strategies that support the business strategy and in the end increase customer value" (p.67). According to Cao et al. (2012), using social media for job-related purposes has, among other motivations to use, the ability to increase connectivity by, for example, developing and maintaining professional networks, strengthening social ties with peers, collecting and analysing information and sharing knowledge and resources.

Besides the motivation to use social media, we know little about the impact of social media on the network ties within a team or department (Tsay et al., 2012), albeit some studies confirmed a positive relationship between the use of social media and productivity increases at the workplace in restricted, non-procurement related samples (Cao et al., 2012). Rozemeijer et al.

(2011) found that procurement professionals perceive social media as a tool to improve collaboration with stakeholders as well as suppliers, to increase purchasing performance as well as to improve the quality of sourcing decision-making. One reason is that increased connectivity between team members encourages trust and leads to a feeling of psychological well-being, which can lead to increases in creative work involvement (Kark and Carmeli, 2009; Ryan and Frederick, 1997). The first contact established with colleagues is usually done through the individual's engagement (Uzzi, 1996), and social media provides one way for procurement professionals to overcome relationship initiation barriers and connect with internal stakeholders as well as external peers (Ellison et al., 2007; Scharlott and Christ, 1995). Even though relationships are established via the social ties of individual professionals, they may, over time, be transformed into personal work relationships (Granovetter, 1985). Relationship development capability is seen as crucial for both managers and professionals (Leuthesser and Kohli, 1995; Smith, 1998) and the trend towards fewer, but more collaborative buyer-supplier relationships and more, tied relationships within a procurement team underlines the importance of relationship development capabilities. A positive effect on creativity might only take place, if social media is used for a certain purpose, namely to connect with peers to work on the higher goal of achieving creative solutions. It is assumed that the direct positive effect of job-related social media use on job-related creativity is only present if valuable connections are established, maintained and developed.

This study will test the mediation effect of connectivity among team members on the relationship between social media use and creativity.

Hypothesis 4 a + b: The relationship between active (a) and passive (b) job-related social media use and procurement job performance is mediated by individual connectivity

Combining our hypotheses results in in the following conceptual model that we try to validate in the coming section.

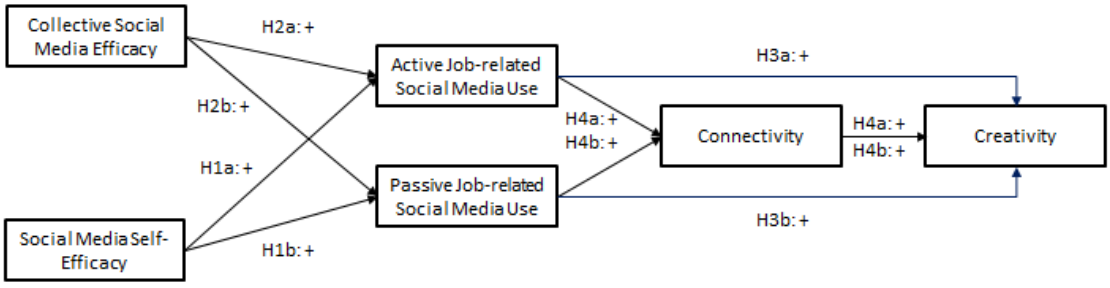

Figure 1: Conceptual Model

METHODOLOGY

Model validation

We interviewed several procurement professionals from different industries to validate the findings of our literature review and to sharpen our research hypotheses. The semi-structured interviews followed the guidelines regarding conducting and documenting research-interviews to ensure academic validity (Yin, 2013). All interviews lasted about one hour, were held on the phone and promised confidentiality to facilitate candid responses. The guide was divided into general questions about job-related social media use, questions on the connectivity among team members and creative processes or results that emerged from projects that were resolved creatively, as well as demographic differences that the procurement professionals observed concerning job-related social media use.

A purposeful sample was chosen, consisting out of five procurement professionals from different industries (i.e. Retail, Consultancy, Automotive), positions (i.e., Team lead, Consultant, Director) and ages (i.e., 25–55 years) to reflect the broad spectrum of procurement professionals. All interviewees pointed out there is a substantial difference between the types of use (either active or passive). Hence, we maintain to split the use of job-related social media use into *active* and *passive* use. For the antecedents influencing the use of social media (i.e., social media self-efficacy and collective social media efficacy) most the interviewees proposed a positive effect on both active and passive use of social media and to stay connected with peers. The insights from the interviews confirmed our conceptual model.

Sampling and data collection

The data collection for this study was executed utilizing a self-administered online questionnaire due to reasons such as cost-limitations, rapidity of responses and a respondents perseveration of anonymity (Manzo and Burke, 2012). The sample was restricted to procurement professionals (e.g., strategic buyer, CPO, commodity manager). Furthermore, only procurement professionals who could make use of social media at work (hence, social media use was not blocked by firewalls or strict company regulations) were selected for the survey to ensure that the self-reported effects were not imaginary. Hence, in accordance with the techniques proposed by Fricker (2008), two convenience sampling techniques were applied: (1) Harvested e-mail lists and (2) unrestricted, self-selected surveys.

The invitations to participate in the survey, including a direct link to the web survey, were distributed via emails in the authors' professional networks. In addition, the web survey link was shared on different social media channels. First, the link was shared multiple times (different weekdays and times during the days) via the social micro-blog Twitter. Second, the link was shared on the public professional networking sites LinkedIn and Xing via posts containing the link as well, as well as through posting the invitation to participate and the link in procurement related groups. Third, the link was shared on the public procurement specific social networking site Procurious (www.procurious.com) using status updates and discussion groups. Lastly, the link was incorporated in one edition of the Procurious[1] Newsletter, which is sent to all Procurious members who have been subscribed to the mailing list as well as shared among all NEVI[2] members in the Netherlands.

In total, 245 respondents started the survey. After assessing the first filter question (do you work in a procurement related position?), 26 respondents (10.61%) were excluded. Of the remaining 219, 26 respondents (11.87%) indicated that they were not allowed to use social media at work (second filter question). In the next step, a list-wise deletion of non-random, non-complete entries was conducted as well as an outlier removal process was examined. After deletion of all outliers and missing data, 149 valid responses were obtained, for which median replacement for responses with less than 5% missing data was used (Lowry and Gaskin, 2014). An effective response rate cannot be determined due to the different, non-traceable channels used to obtain respondents. Sample demographics show an even distribution of positions and tenures representable for each position present in the sample.

Sample-selection, non-response bias, and common method variance

[1] Procurious.com: An online business network for procurement and supply chain professionals
[2] NEVI: Nederlandse Vereniging voor Inkoopmanagement (Dutch Purchasing Management Association)

According to Manzo and Burke (2012), a survey need to be unrestricted, open to public and self-selected. The survey of this study was shared via multiple social media channels and private communication. To avoid a selection bias of respondents who are familiar with social media platforms, the last question of the survey asked respondents how they got access to the survey. The analysis of the responses to this question indicates that non-probability sampling is not an issue in this study, as many different channels to access the survey were used by respondents. Furthermore, to test for the existence of the non-response bias, this study followed the assumption of Fielding et al. (2008), stating that late respondents and non-respondents share similar attributes. Using demographics variables and at least one randomly selected indicator per construct, there were no significant differences found between the early and late respondents (at $p < .001$).

Due to scope restrictions of this study, information about the dependent and the independent variables was gathered from the same individuals. Hence common method variance could be present in this sample. Common method variance can inflate or deflate the observed relationships between constructs, therefore leading to Type I or Type II errors (Armstrong & Overton, 1977). Several steps were undertaken in the survey to avoid common method variance, namely assuring anonymity, careful wording of items and placing predictor and dependent criteria far away from each other in the questionnaire to avoid relationship-guessing by the respondent. In addition, Harman's single-factor test was conducted to prove the non-existence of common method variance (Podsakoff & Organ, 1986). A factor analysis in SPSS was performed using all constructs to test the un-rotated factor solution. The largest factor did account for 15.87% of the variance. Consequently, it was concluded that common method variance is not present in this study.

Measures

All constructs consist out of multi-item scales, which were previously proven to be highly reliable, based on their Cronbach alphas from preceding research (Podsakoff and Organ, 1986). Some of the scales were slightly adjusted and adapted towards the specific procurement context of this study. Unless stated differently, all variables were measured on a five-point Likert scale to ensure statistical validity (Santos, 1999).

Social media self-efficacy: Social media self-efficacy is a reflective construct of a participant's (1) perceived social media skill, (2) confidence in the ability to find information, (3) level of content production and (4) level of content consumption and measured with ten items in total. As the scale was not publicly available, Hocevar et al. (2014) provided us the scale on our request. The scale was slightly adapted to fit in our research context. Social media skill (1) and confidence in ability to find information (2) were measured using a five-point Likert scale ranging from (1) "much worse" to (5) "much better" including items as *"On a scale of 1 to 5 (1 = much worse, 5 = much better), rate your ability to find what you are looking for on the social media, compared to other Internet users"*. Social media content production (3) and consumption (4) included four items each, measured on a five-point Likert scale ranging from (1) "never" to (5) "very often".

Collective social media efficacy: We utilized the collective efficacy beliefs scale by Riggs et al. (1994) and adapted the scale towards the belief in social media efficacy of a department. Three items were measured on a five-point scale containing items such as *"This department is poor compared to other departments doing similar work"* which was rephrased to *"Compared to other departments, the department I work in is only poorly using social media for work-related purposes"*.

Use of job-related social media: This study is eager to differentiate between the active (creating and sharing content) and passive (consuming content) use of social media. Hence, by expanding the active job-related use of social media scale and altering the passive scale, the scale was

adapted based on the results of Pagani et al. (2011). The active use of social media at work construct contained four items. For example, *"I often spend time in creating social media content related to procurement"* or *"I frequently talk to other people from my industry or professional community via social media"*. The passive use of social media at work was similarly established with four items, asking the respondent questions like *"I often use social media to obtain work-related information and knowledge"* or *"I often spend time browsing social network content related to my work created by others"*.

Connectivity: The connectivity scale was borrowed from Kark and Carmeli (2009) to measure how well an employee is connected to his procurement department. A four-item five-point Likert scale as in the original study was adapted to fit the content of this study.

Creativity: Following Dobni (2008), we used the innovation scale as a proxy for creativity of procurement professionals. The items consist of questions such as *"I consider myself to be a creative/innovative person"* and *"I feel that I am good at generating novel ideas"*. In total, seven items were administered on a five-point Likert scale ranging from (1) completely disagree to (5) completely agree.

ANALYSIS AND DISCUSSION

Variance-based structural equation modeling was used (Partial Least Squares; PLS-SEM) to maximize the total explained variance of the dependent variables, caused by the independent variables (Haenlein and Kaplan, 2004). The PLS-SEM analysis was conducted in SmartPLS (version 3.2.3), using a path weighting scheme with 500 iterations and a stop criterion of 10^{-7} and a bootstrapping procedure with 5,000 subsamples, individual sign changes and a two-tailed significance level of $p < .05$ (equivalent to $t > 1.965$; Hair et al., 2011).

Outer Model – Results

This study employs an iterative process to remove insignificant indicators and indicators with low loadings while monitoring the effects on Cronbach's alpha, Composite Reliability and the Average Variance Extracted (AVE). All latent variables scored higher than .70 for Composite Reliability and all but one Cronbach's alphas pass the threshold of .70. For the Collective Social Media Efficacy construct, the Cronbach Alpha value is 0.621 which is acceptable given that the rho_A (1.263) and composite reliability (0.704) values are above the thresholds (Dijkstra and Henseler, 2015).

Following popular literature, the AVE is used to assess convergent validity of reflective constructs, which should surpass the threshold of .50 (Fornell and Larcker, 1981). All AVE values exceeded the value of .50, which implies validity at construct level, as the indicators explain more than half of the variance in the respective constructs (Peng and Lai, 2012). To address the discriminant validity, this study uses three approaches, namely the Fornell-Larcker criterion, the examination of cross-loadings and the heterotrait–monotrait ratio (HTMT). Discriminant validity has been established for all latent variables in this study when assessing the Fornell-Larcker criterion, the cross-loadings approach or the HTMT ratio.

Inner Model – Results

The R^2-value of the model is .215 and considered to be medium, describing a fair amount of variance in the dependent variable creativity. The PLS algorithm was used to determine the path coefficients, using a bootstrapping procedure with 5,000 subsamples to test for significance (Hair et al., 2011). A strong and highly significant, direct effect was found for social media self-efficacy on the active and passive job related social media use ($\beta = .650$, $t = 13.755$, $p < .001$; $\beta = .633$, $t = 14.422$, $p < .001$). Hence, hypotheses 1a and 1b are supported. In addition, a significant direct effect was found for the variable collective social media efficacy on active job related social media use ($\beta = .186$, $t = 3.273$, $p < .001$). These results support hypothesis 2a,

whereas hypothesis 2b is rejected as no significant effects of collective social media efficacy on passive use of social media at work were found.

To test for the mediation effects of connectivity on creativity, the direct effect of active and passive job related social media use was assessed first. A significant, direct effect was found for the active job-related use of social media on creativity ($\beta = .318$, $t = 2.998$, $p < .001$), whereas the direct effect of passive use of social media was found to be insignificant ($\beta = .027$, $t = 0.374$, $p > .05$). Hence, hypothesis H3a is supported, whereas hypothesis 3b is rejected. Secondly, the mediation effect of connectivity is measured. The direct, large effect of connectivity on creativity is significant ($\beta = .350$, $t = 4.356$, $p < .001$), while connectivity is significantly affected by passive social media use ($\beta = .206$, $t = 2.036$, $p < .05$). The effects of active use of social media on connectivity are insignificant ($\beta = -.041$, $t = .508$, $p > .05$) while the direct effect of active social media use on creativity remains ($\beta = .278$, $t = 3.685$, $p < .001$). Although our data does not support hypothesis 4a, we do find support for hypothesis 4b. The complete path model including coefficients and t-values is shown below in Figure 2.

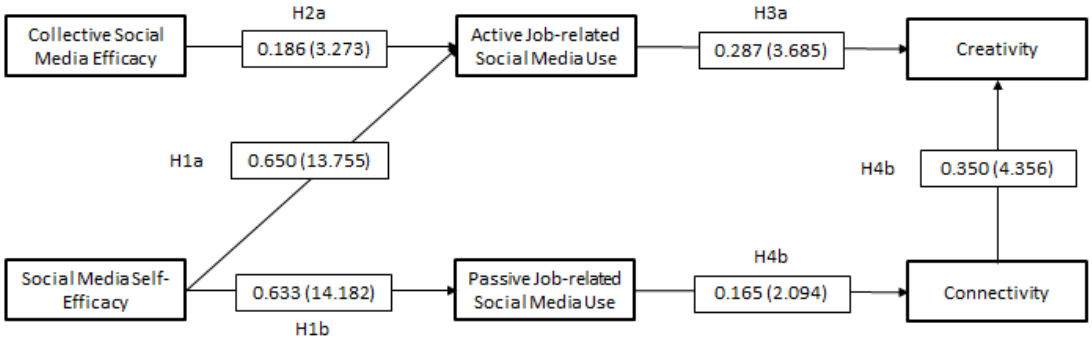

Figure 2: Significant path coefficients and t-values

Social media use in the private context is strongly driven by the age of the users (Bolton et al., 2013; Chaffey, 2016; Correa et al., 2010; O'Keeffe and Clarke-Pearson, 2011). To test for this heterogeneity effect in our sample, we divided our sample into two distinct age groups, namely Generation Y (and younger) and Generation X (and older), as previous research shows that these two generations differ in terms of how they actively (generating content) and passively (receiving and evaluating content) use social media platforms (Leung, 2013). We follow the definition of Howe and Strauss (2009) who defined Generation X as born between 1961 and 1981 and Generation Y as born between 1982 and to 1997. Splitting our sample into these two groups results in 39.2% of the sample being in the 'Gen Y' condition and 60.8% in the 'Gen X' condition. We estimated two separate PLS path models using Smart PLS Multi-group Analysis (MGA) to account for the continuous moderation effect of the variable at hand (Sarstedt et al., 2011; Vinzi et al., 2010) .

Comparing our two models, the R2-value of creativity in the Gen Y model is .295, whereas the Gen X model's value is lower at .169, yet a parametric test shows that these differences are not significant ($t = 1.041$, $p > .05$). Comparing the path coefficients among the two models revealed several notable differences. First, the PLS-MGA indicates a significant difference between Gen Y and Gen X on the path from collective social media efficacy to active job-related social media use (β diff. $= .525$, $p < .001$). Examining the paths for the different models shows a positive and strong effect of collective social media efficacy on active job-related social media use for Gen Y ($\beta = .404$, $t = 4.837$, $p < .001$), whereas for Gen X the relationship is weak and negative ($\beta = -.121$, $t = 1.659$, $p < .05$). Second, the relationship of social media self-efficacy on active job-related social media is significantly different (β diff. $= .295$, $p <$

.01) in such that for both generations the relationship is positive, but for Gen X (β = .740, t = 15.524, p < .001) it is significantly stronger than for Gen Y (β = .446, t = 4.558, p < .001).

Third, similarly we observe differences among the two generation for the relationship between passive job-related social media use and individual connectivity. The PLS-MGA results in a significant difference for this relationship across both models (β diff. = .563, p < .001), due to the fact that for Gen Y this relationship is strong and positive (β = .425, t = 3.973, p < .001), whereas for Gen X the relationship is weak and negative (β = -.138, t = 1.677, p < .05). All other path coefficients are significant as in the initial model but did not differ significantly across the two generation models. Overall, these results show that there is a difference among the two generations and how their social media use is affected as well as how it influences their individual connectivity and creativity.

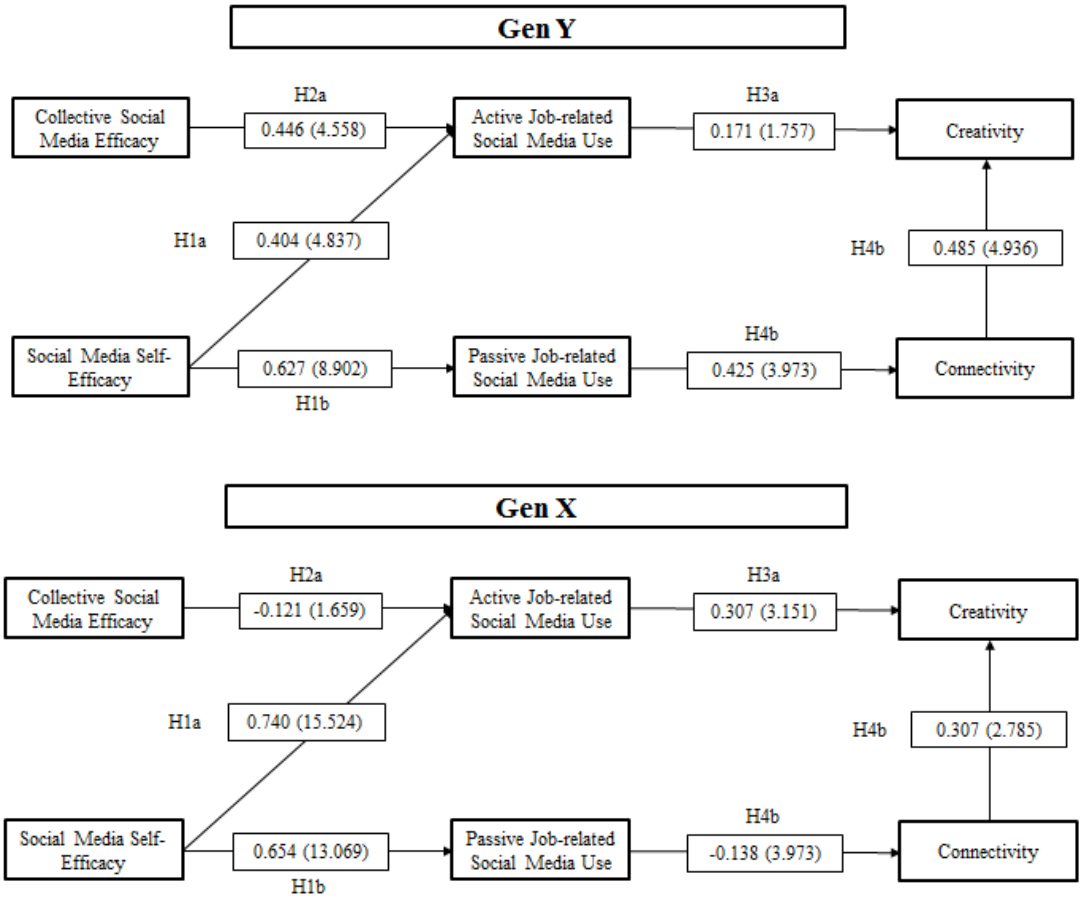

Figure 3: Significant path coefficients and t-values for the Gen Y and Gen X model

The findings support and build on prior results on the relationship of social media self-efficacy on the active and passive job-related social media use, confirming a significant, positive relationship, which was exclusively tested for private social media use in prior studies (Hocevar et al., 2014; Krämer and Winter, 2008). Furthermore, the collective social media efficacy in the department of procurement professionals has a positive impact on the active social media use but does not affect the passive use. Our model shows a positive direct relationship between active use of social media and creativity and this relationship is, in contrast to our hypothesis, not mediated by individual connectivity. The direct effect on creativity is only present for the active use of social media, while passive use of social media indirectly positively affects creativity through connectivity. Connectivity is only significantly affected by passive social media use.

The positive impact of job-related passive use of social media on creativity produces essential implications to procurement professionals from several perspectives. Firstly, many companies still suppress the use of social media at work via codes-of-conduct or technically blocking social media platforms, due to the perception that it reduces individual productivity and job performance. Our research finds evidence against this common belief. Procurement professionals do report more creativity when companies allow them to actively and passively use social media for work purposes. Secondly, from a recruiter's or manager's perspective, knowing the positive effects of social media use, social media self-efficacy, and collective social media efficacy should be tested when hiring new procurement employees or assessing the procurement department's creativity climate. In addition, it might be desirable to design a job environment in which procurement professionals have a certain freedom of deciding on how their daily tasks and projects are undertaken, as one positive result could be the use of social media to enhance creativity.

The MGA analysis shows different finding for Generation X and Y. Collective Social Media Efficacy increases Active Job-related social media use for Generation Y but decreases it for Generation X. Potentially, Generation Y feels encouraged to use social media actively if they believe the collective has strong skills. They 'adapt' to their environment. Generation X however feels threatened by the collective skills; therefore rather does not engage in the unknown territory of social media Social Media Self Efficacy's effect on Active Job-related Social Media Use is significantly stronger for Generation X than for Generation Y. Generation X seems to use active social media more if they believe that their individual efficacy is high, independent on what the collective/team is doing. For Generation X, self-efficacy is the main driver, whereas for Generation Y both, self and collective efficacy, are the drivers for active use. Passive Job-related Social Media Use increases Connectivity for Generation Y but decreases for Generation X. Generation Y uses passive social media to stay connected and have constant updates about their peers, while Generation X most likely uses other ways to stay connected and feels rather threatened by using passive social media

CONCLUSION

The theoretical findings of this study contribute and extend current research in the fields of social media and procurement while differentiating between the types of social media use and assessing the mediating effects of individual connectivity. Firstly, consistent with previous research (Chuang et al., 2015; Hocevar et al., 2014; Wang et al., 2015), social media self-efficacy is positively associated with the use of social media. However, this study extends current research and proves that the positive relationship, which holds for (any) private use of social media, is also present when using social media in a work context for job-related purposes and furthermore confirms the relationship for active use (i.e., producing content) and passive use (i.e., consuming content). Secondly, this study contributes to our knowledge on the relationship between collective social media efficacy and social media use at the workplace, which has not been researched up until today. Thirdly, the positive relationship found between active job-related social media use and creativity shines light onto an vital tool that procurement professionals can use to enhance their creativity, and through that increase their job performance (Cao et al., 2012; Jue et al., 2009; Paniagua and Sapena, 2014). It is proven that the effect is partially an indirect effect. For the passive use, the effect is mediated by individual connectivity, which implies that the plain, passive use of social media, in the context of procurement only enhances creativity when the procurement professional is well connected to his procurement team or department.

Despite the insightful findings of this research, several limitations need to be mentioned. First, the sample size of 149 valid responses needs to be considered when generalizing the results of this study. Additionally, the sample did not control for differences in industries or managerial

positions due to the small sample size. Research with a larger sample size needs to be conducted to ensure generalizability. Second, the study was conducted and controlled for data collected at one point in time. Hence, this cross-sectional research does not allow to measure causal effects appropriately. This issue could be overcome with a longitudinal study, which elaborates on the impact of job-related social media use over time, as well as measuring the effects of job-related social media use on job performance from a time-dependent perspective.

Next to the abovementioned limitations, several directions for future research can be derived from this study. To begin with, the underlying sample mainly had a European background (85% European, 6% North America, 9% other), with a strong focus on Western Europe nationalities (49% Dutch, 15% Swedish, 12% German, 5% British), thus future research could investigate the generalizability across different nationalities and other controlling variables, as internet use in the a country, education level or innovation index. This research focused on factors influencing the use of social media at work for procurement professionals. However, it is assumed that there are additional factors that could be examined to deepen our understanding of job-related social media use in the procurement context. Next to individual connectivity as our single mediating variable, we believe that more research is necessary to fully understand other potential mediators when trying to understand the antecedents of creativity in a procurement context.

Thus, additional research is necessary for developing a broader theoretical and practical understanding of the relationship between social media use and procurement creativity in the 21st century.

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Orchestrating and coping in healthcare networks over time: the role of social capital

Carmen Hendy

Cardiff Business School, University of Cardiff, Colum Drive, Cardiff, UK CF10 3EU, HendyC@cardiff.ac.uk

Anne Touboulic

Nottingham University Business School, Jubilee Campus, Nottingham NG8 1BB, UK anne.touboulic@nottingham.ac.uk

Christine Harland

Dip. Ingegneria Gestionale, Politecnico di Milano, Via R. Lambruschini, 4/B, Edificio BL26/B, 20156 Milano, Italia, Tel. +39 02 2399 4797, Email: christinemary.harland@polimi.it

Yingli Wang

Cardiff Business School, University of Cardiff, Colum Drive, Cardiff CF10 3EU, UK, WangY14@cardiff.ac.uk

Abstract

This paper presents empirical insights into the dynamics of a complex inter-organizational network as it develops over time. We take a 'whole network' perspective to show that actors in networks use and develop social capital – individual, organizational, relational and network social capital– as the glue holding networks together as they change dynamically over time. The role of the hub organization also changes through the phases of development of the network. It continually works to orchestrate the flow of network resources, but over time these orchestration actions move between coping, adapting, planning and controlling activities.

Keywords

Inter-organizational network, orchestration, longitudinal case study, social capital

Introduction

Research in complex inter-organizational networks seems to fall into one of two camps. The first, often associated with Complex Adaptive Systems (CAS) and IMP Network Theory, is an emergent view of networks where actors are conceived as adapting and reacting, whilst the second takes a more directed view of networks and actors are conceived as proactively orchestrating network resources, in line with Resource Orchestration Theory (ROT), developed from Resource Based View (RBV).

To date there has been limited empirical research that takes a 'whole network' (involving all the key network actors) and longitudinal perspective in order to unveil the dynamics at play in the development of complex networks. We lack research that sheds light on the way in which diverse actors come together in these networks to address complex challenges. The unfolding and leveraging of network relationships is fundamental to the success of a network (Galaskiewicz, 2011), yet the difficulties of conducting whole network studies have acted as a barrier to expanding our knowledge in this area.

In this paper, we contribute in this direction through an empirical study of a complex whole network in healthcare, spanning public and private boundaries and bringing together actors to increase the uptake of innovation in local health systems.

Conceptual foundations

Inter-organizational network social capital

Inter-organizational networks are capable of addressing complex problems and sharing scarce resources to achieve network goals (Keast et al., 2004, Bryson et al., 2006, Weber and Khademian, 2008, Hoberecht et al., 2011). They can improve efficiency, legitimacy, power and help manage uncertainty arising in complex settings (Isett and Provan, 2005, Pesämaa, 2007, Hoberecht et al., 2011, Isett et al., 2011). They have been shown to improve service delivery, advance innovation, support risk distribution and share accountability (Pesämaa, 2007, Hoberecht et al., 2011). A more holistic, whole system perspective provided by working in inter-organizational networks enables key managers to understand bigger, more sustainable solutions (Hoberecht et al., 2011) that individual organizations and managers cannot achieve independently (Provan and Kenis, 2008, Weber and Khademian, 2008). In particular, wicked problems such as poverty and global warming, and reform of complex services such as education and healthcare, cannot be solved by single agencies, organizations and even sectors (Huxham and Vangen, 2005, Hoberecht et al., 2011). These complex problems facing societies and economies provide a "moral imperative" to collaborate across organizations and sectors (Popp et al., 2013).

Public services are provided through complex inter-organizational networks involving government departments and agencies, public procurement offices, private sector providers of goods and services, industry representative bodies, regulatory bodies and a range of other stakeholders. Whilst the importance of understanding dyadic relationships within public management networks is recognised, (Isett and Provan, 2005, Provan and Lemaire, 2012), the provision of health and social care services are viewed as particularly suited to inter-organizational networks as a mechanism (Reid, 1995, Berry et al., 2004).

A public management inter-organizational network typology identifies three main types of networks in the public sector - policy networks, collaborative networks and governance networks (Isett et al., 2011). All three types are present in public management (Popp et al., 2013), but collaborative networks are the most common type of networks found in healthcare (Eisingerich et al., 2009). Collaboration in these inter-organizational networks may involve suppliers of goods and services, government departments and agencies, not for profit

organizations, community representatives and members of the public (Bryson et al., 2006, Rethemeyer and Hatmaker, 2008).

Social relations in inter-organizational networks lead to connections that can be used – sociologists term these 'ties' (Granovetter, 1973, Granovetter, 1983, Granovetter, 1985, Collet, 2003, Burt, 1983, Burt, 2000, Burt, 2009, Walker et al., 1997) and their exploitation can give rise to benefits, termed social capital. It is only relatively recently that academic scholars have sought to understand how social networks work; previously managers have communicated to promote collaboration without necessarily understanding the workings of the social network involved in that collaboration and the potential outcomes. Within organizations it has been observed that social networks are deliberately used to assess strategy execution, improve strategic decision-making in top leadership teams, integrate across core processes, ensure integration post large scale change such as merger, and develop communities of practice. More recently, academic interest has focused on the use of social networks in supporting partnerships, alliances and the management of inter-organizational relationships (Cross and Parker, 2004, Kilduff and Brass, 2010, Galaskiewicz, 2011). Some social networks form for the purpose of interacting but others are deliberately formed to solve complex problems (Ryan, 2011). Social networks and inter-organizational networks have largely been studied separately, with some authors highlighting the value of seeing them as distinctly different. However, some attention has been paid to the interaction between social networks and inter-organizational networks, observing that sometimes social networks lead to the formation of inter-organizational networks, and vice versa (Brass et al., 2004, Harryson et al., 2007, Kenis and Oerlemans, 2008, Gulati et al., 2011, Larimo and Vissak, 2009, Voinea and Stephan, 2009). Actors in a social network can be individuals, teams, organizations, regions, or countries (Liebowitz, 2007), and communications technology development from telegraph, radio, telephone and internet has allowed social networking to occur more easily over any distance (Churchill and Halverson, 2005), thereby easing network formation and development.

Time and network development

The concept of time is a central, yet often implicit, dimension in organizational and management research. In recent years increased attention has been paid to the temporal dimension of organizational studies (Reinecke and Ansari, 2015), with authors arguing that it constitutes a meta-dimension of management (Chen and Miller, 2011). Temporality has been particularly central to process research (Langley et al., 2013) that has focused on theorising processes of organizational change. Methodologically, while time is not always explicitly mentioned, studies that embrace longitudinal designs provide insights into the evolution of organizational events and structures over time. This aligns with a process-orientated or qualitative perspective on time, where "there is no beginning or end of time, only unfolding moments and ongoing transformations" (Reinecke and Ansari, 2015: 261). In this perspective, time flows and resides not in the clock measure, but in the unfolding of organizational life.

Interestingly, network studies have a relatively long tradition of embracing time and temporality as core dimensions, particularly in their attempts at making sense of and theorizing the evolution of network structures and inter-organizational ties (Lorenzoni and Lipparini, 1999). Several studies adopt longitudinal designs to study phenomena at the network level (Provan et al., 2007). This is certainly a reflection of the complexity of networks and their dynamics, and therefore it is necessary to study them empirically over a period rather than cross-sectionally in order to be able to draw reasonable conclusions about their nature and processes. Nonetheless dominant network theories still seem to offer very static frameworks.

Supply chain management research on the other hand, remains primarily cross-sectional and has shied away from engaging with ideas of temporality. Klassen and Hajmohammad's (2017)

recent contribution is a notable exception, offering multiple perspectives on time in relation to sustainability and competitiveness. Supply chain management activities and problems are by nature related to processes; sourcing and relationship development are themselves processes that happen over time. Hence there exist opportunities to offer more longitudinal and temporal frameworks of supply networks.

We embrace time in our process of theorising as we see it as a core dimension of the development of networks taking place at the tensions between control and emergence. A temporal view of network development and social capital orchestration in this context allows for a richer and more accurate conceptual framework.

Methodology

Empirical whole network studies

One of the challenges in researching inter-organizational networks is bounding the network being researched; so called 'whole network' studies (Provan et al., 2007) contain key organizations involved in the provision of a product or service that is the focus of the research question being asked. The most simplistic approach to bounding a network is including within its boundary all the organizations with membership (Valente et al. 2008; Alvarez, Pilbeam, and Wilding 2010). Alternatively, membership might be taken as a starting point and then certain member organizations might be excluded on the basis of empirically evidencing whether the organization actively participates in the network, or are just being considered to be a member as a formality (Human and Provan 2000). On the other hand, in some studies network boundaries have been expanded beyond membership, since, after snowballing, key informants thought other organizations were relevant to be included in the study (Robins, Bates, and Pattison 2011; Morrissey, Johnsen, and Calloway 1997).

In other studies of inter-organizational networks, network 'membership' has not been quite so explicit. For example, a study on supply networks in the automotive industry set boundaries based on a specific assembly (Choi and Hong 2002) and which organizations were centrally involved in the supply of components for this assembly. In another example, level of turnover, if they were legal persons and if they could compete for public works were criteria used to include and exclude organizations for the network to be researched (I. Castro, Galán, and Casanueva 2009). In a study focused on lean, researchers chose to include organizations in the network who used lean practices (Bortolotti et al. 2016).

The challenges and limitations of network bounding criteria have been recognised (Henry, Lubell, and McCoy 2012); it was observed that researchers' choice of who they included impacted on responses of network organizations to interview questions. When researchers did not specify organizations in their questioning, interviewees responded only about those whom they had strong relationships with and omitted those with weaker relationships. When researchers specified organizations, interviewees did not consider other organizations with whom they had strong relationships.

A set of elements for researchers to consider when examining inter-organizational networks has been provided (Halinen and Tornroos 2005). They propose that the objective and research question should determine the particular theoretical perspective to be taken. Inter-organizational networks are complex multi-dimensional systems (Raab, Mannak, and Cambré 2015), making choice of theoretical perspectives to be taken a complex decision for the researcher.

However, overall, most research to date on inter-organizational networks has emphasized the organizational level; there is little evidence of research that considers effects at the network level.

Research approach and context

The findings are drawn from case study research with embedded sub-units. A five year longitudinal study and a cross-sectional study of health care networks were examined, representing two embedded sub-units within an overarching case of a large regionally based healthcare network. An embedded case study was selected as a suitable methodology because it enabled detailed investigations of organizations and organizational processes to be conducted whilst capturing the contextual factors and social embeddedness of the phenomenon under study (Yin, 2003, Miles and Huberman, 1994).

Data collection and analysis

A total of 41 interviews were conducted with multiple respondents within the networks. These were digitally recorded and later transcribed. This data was complemented with documents and participation and note-taking in meetings. In conducting the analysis, we were interested in how the network developed over time, and the role of the hub organization in this development in facilitating action and the achievement of network goals. The data analysis process was based on the principles of abductive reasoning whereby the researchers engaged in a to-and-from method between the empirical and the conceptual, in order to make sense of the phenomena under study (Ketokivi and Choi, 2014).

Findings

In the case the network is formed around a non-traditional hub organization – a social enterprise spanning the public and private sector with a mandate to facilitate and affect change at the levels of individual practitioners, health organizations, health systems and the wider community. The network has been formed, in part, to increase the uptake of innovation in the local health system and provide a route into the health system through forming temporary supply chains connecting innovations to those with purchasing power and at times directly to end users (practitioners and patients).

Social capital in a healthcare innovation supply network

In this context social capital, at an individual, organizational and network level, was a key resource leveraged and developed by the hub organization and valued as an outcome by members. The hub organization's pattern of connections to the local health community, the extent to which its values reflected those of potential network members and its reputation, as well as the subsequent trust this engendered, supported its position of influence. However this static view of social capital as a resource for the hub organization did not sufficiently capture the role of social capital in network development and through the course of this study the dynamic nature of social capital has become apparent.

The extent to which a network represents a context in which social capital is leveraged (bridging social capital) versus one in which it is developed (bonding social capital) changes over time. (Ansari et al., 2012). The beneficial outcomes of the leveraging and development of social capital can move between the individual, organization, network and community levels. The extent to which different individuals and groups can use their social capital to gain an advantage in the context of the network changes over time. The impact of the different dimensions and forms of social capital on the network also change over time. The relational dimension of social capital is a more emergent property, whilst cognitive and structural dimensions both emerge and can be controlled or orchestrated. Network social capital represents the social capital in the network that has been activated and developed and is therefore the form of social capital most available for orchestration.

Role of orchestration in network development over time

Over the course of our observations, both over time and between the two embedded sub units, the role of the hub organization in the developing network changed. The network went through four phases of development; initiation, formation, initial collective action and maturing collective action (Harland et al., 2017). During the different phases the hub organization worked continually to orchestrate the flow of network resources, but over time these actions moved between coping, adapting, planning and controlling activities. As social capital was a significant resource for this network the extent to which the hub organization could orchestrate this for the benefit of the network was an important factor in its development. Further, the dynamic nature of network social capital meant that its changing form, position and availability influenced the ability of the hub organization to cope, adapt, plan and control. To this end the degree to which network properties emerged, with the hub organization merely coping with the outcome of this, or were fully orchestrated was a function of timing (i.e. phases) and activation of different parts of social capital across different areas and levels of the network. Figure 1 summarises our ongoing conceptual development of these phenomena.

Discussion

This study has highlighted the importance of factoring time into our understanding of networks and the variables under observation. Network structure, activities, goals and roles change over time, however this additional demonstration of how multi-faceted network variables such as social capital move around the network structure, mutate form and change utility over time adds to the understanding of how time significantly shapes understanding of relationships between variables in networks. Social capital and its different facets and forms do not develop and mutate at the same rate within the network context. For example structural connections form earlier than the cognitive dimension of developing a shared understanding. Relational elements such as trust based on reputation are high during the initiation of the network, reduce during formation as expectations based on reputation are challenged and then increase through joint working and development of shared understanding.

Time also plays a role in the availability of bonding and bridging social capital; in the early stages bridging social capital is more highly available as new connections are most abundantly available and over time the potential to create bonding social capital increases as a stronger network identity or shared language is developed. However the utility of these two forms of social capital also changes over time, moderated by changing network goals and activities. During formation, investment in developing bonding social capital is emphasised as network purpose and structure are refined, however in the later stages being able to utilise bridging social capital to diffuse, distribute and publicise the network's activities becomes increasingly important. This shift in emphasis between bridging and bonding social capital and the dynamic nature of this over time appear to be important for network development

In this context the hub organization attempts to play a number of different roles over time. However its ability to influence the network via the forms of hierarchical power used in a traditional organization structure is significantly limited. One factor shaping its source of influence was the pattern of resource availability. At an organizational level it had a high level of social capital but less access to other resources. Significantly other resources available to the hub organization, such as knowledge and financial capital, are frequently deployed in order to develop further organizational social capital and network social capital as either a primary or secondary outcome. The hub organization's access to social capital supports its ability to orchestrate network activities, and yet a significant portion of these orchestration activities are concerned with the mobilization and development of social capital across the network.

Over time tensions form within the network as the development of bonding social capital decreases the uniqueness of the social capital available to the hub organization and therefore reduces its ability to influence the network. This is countered, to some extent, with significant efforts of the hub organization to maintain centrality within the network. However, it is also important to note that over time the need for central control also varies particularly as the network moves into more mature collective action; in this phase there are more clearly defined goals, roles and high levels of bonding social capital supporting network processes. At this later stage the resilience of the network can support a form of network coping and adaptation up to a point without significant central planning and control. However the underlying plan remains in place and monitoring for deviation from the plan that is jointly owned, but centrally organised, acts as a form of more subtle control. These joint metrics reinforce bonding social capital as they contribute to a shared language and understanding, and the transparency with which they are shared adds to the level of trust across the network.

This study has taken a whole network approach and whilst we have frequently observed orchestration from the perspective of the hub organization, which undoubtedly plays a pivotal role, in seeking to understand the role of social and network social capital in orchestration processes we begin to see how orchestration is a function of the whole network. Individual organizations at different times are able to exert more or less control over the network's activities, but this is shaped by their own social capital, the social capital within the network and time. Consequently we can see that orchestration is not a top down process and over time network development can appear to take on an emergent quality. However the ability of a hub organization to mobilize social capital can enable it to take control at pivotal moments particularly related to managing network boundaries.

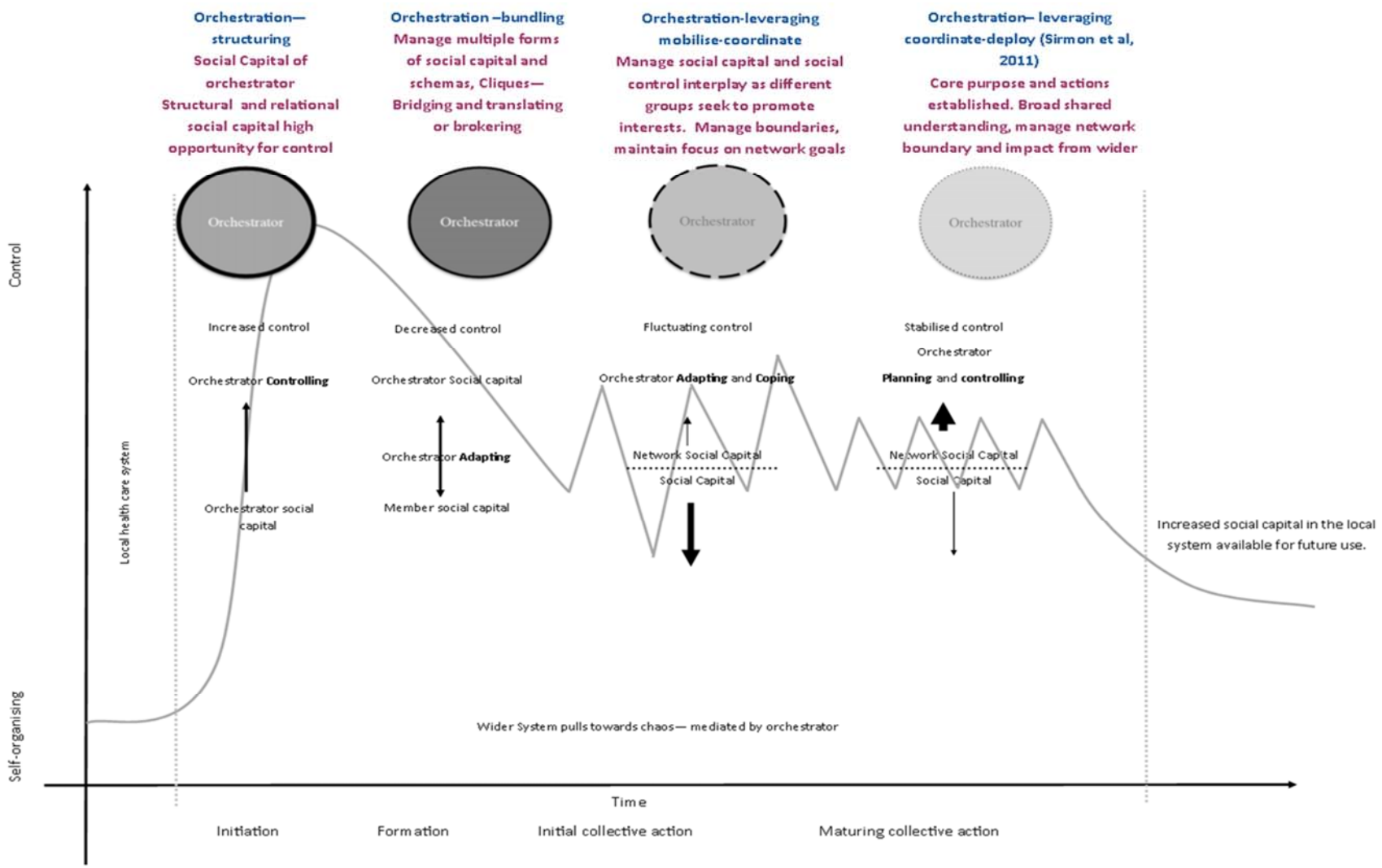

Figure 1. Orchestrating and coping through phases of network development

Conclusion

Via an extensive longitudinal study of two embedded subunits within an overarching case of a large regional health network, our study investigates how the hub organization orchestrates its network for desired economic and social outcomes. We find that network orchestration is a dynamic and complex process. Unlike commercial networks, the hub organization in our case does not occupy sufficient power to 'enforce' network development practices, however social capital is found to be the key conduit to shape the dynamics between organizations and support inter-organizational collaboration. Our study also finds that social capital is continually deployed by the hub organization during the different development phases of the network, but over time the emphasis was shifting between coping, adapting, planning and controlling activities. We contribute to the literature by developing and articulating the concept of network orchestration via the theoretical lens of social capital. Our study also offers insights into the dynamic and complex interplay between members and the hub organization of the network. Finally, our research contributes to unveiling the temporality of complex network activities and development.

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Towards PSM 4.0

An exploratory discussion on the impact of the Internet of Things on Purchasing and Supply Management

Michael Henke
Fraunhofer Institute for Material Flow and Logistics
Michael.Henke@iml.fraunhofer.de

Hervé Legenvre
European Institute for Purchasing Management
hlegenvre@eipm.org

Herbert Ruile
Universities of Applied Sciences Northwestern Switzerland
herbert.ruile@fhnw.ch

Abstract
Industry 4.0 and the Internet of Things (IoT) are transforming industry architectures, traditional business models and processes. This calls for significant adaptations of the Purchasing and Supply Management Function (PSM). The present article aims at stimulating debates between practitioners and academic on this evolution. It first describes the context by exploring why and how the IoT changes industry architecture and favour some specific governance mechanisms. From this, building on three separate research investigations involving practitioners we explore a scenario where PSM is taking a more strategic role while being more digitized. This scenario aims to describe how PSM would evolve in this context and how PSM can manage this transformation. We conclude by suggesting future research areas.
Keywords: Purchasing and Supply Management, IoT, Digital Transformation

Introduction
Industry 4.0 and the Internet of Things are commonly used terms within industry and academia to describe some of the profound changes of our industrial and business foundations. They play a key role in digital transformations. Industry structures will go through significant changes in the next 20 years. The IoT changes products into product/service hybrids. As more and more "Things" get connected, more data is generated and new digital services and business model innovations take place. The impact of the IoT is important, including sectors that were not data intensive in the past, such as agriculture and mining. This will lead to significant re-configurations of value chain networks. Building on the title of a Wall Street Journal article (Andreessen, 2011) we could say that today both "sensors and software are eating the world". We have only seen the first sparks of a broad transformation that will significantly alter industry architectures and changes how companies compete and collaborate within their business ecosystems. The transformation of industry architectures will change the role of the Purchasing and Supply Management (PSM) Function. It could shift back to a more operational role or it could gain further importance. In the present paper we outline a scenario where, by taking an active role in a company transformation, the PSM functions gain further strategic relevance. We start with a definition of IoT and Industry 4.0 and describe how they relate to digital transformation. Following, we outline why and how IoT changes industry architectures and favour specific governance mechanisms. From this we develop a scenario and describe how

PSM could evolve in this context and how PSM could manage such a transformation. We conclude by suggesting future areas of investigation.

2-Background of the research

The present paper result from the consolidation of three separate research investigations that involved altogether hundreds of practitioners. In 2016 the three authors decided to combine their effort due to the exploratory nature of the topic.

The idea of the Fraunhofer IML and BME pilot study was initially based on the belief that the fourth industrial revolution offers procurement a unique opportunity to meet the demand that it plays a strategic role. The opinions of the surveyed procurement managers and Chief Procurement Officers (CPOs) from a total of 25 companies and two universities, form the core of this pilot study, which is designed to act as a source and starting point for more extensive and detailed investigations into the topic of PSM 4.0. When selecting respondents, the focus was placed on achieving a highly heterogeneous participant structure featuring experts from companies representing different sectors and of different sizes. Companies with headquarters based in Germany, Austria and Switzerland were surveyed as part of the study (For more details see Fraunhofer IML and BME, 2016).

In 2015, The EIPM started a research stream on the IoT with semi-structured interviews conducted with 15 CPOs across diverse sectors. Then 120 purchasing managers were involved in focus groups to explore the likely impact of the IoT on their industry and on different dimensions of PSM. Following this, 6 case studies were documented. The outcomes were published in the 2017 edition of the EIPM Value Creation Observatory.

In Switzerland, an expert group was launched in 2016 to explore the impact of Industry 4.0 on PSM Function and to develop a commonly agreed strategic roadmap transforming PSM. The expert group was an outcome of a broad survey performed with purchasing managers in Switzerland, which indicated, that the upcoming digitalization and disruptive transformation of business models will have a huge impact on organization, roles and competences in purchasing and supply management. Eleven purchasing managers from leading Swiss companies have been working closely together with academic and consulting partners to define and challenge a PSM 4.0 roadmap.

During the three streams of investigation, practitioners were not in a position to share a finalized "set of good practices" they had already developed and tested. They mainly presented anecdotal evidence coming from early stage projects and isolated case studies. This was complemented by their personal insights and views on the implications of IoT for PSM. Therefore, we systematically compared and contrasted our findings and decided to build a scenario that could be further questioned and tested. The purpose of this scenario is to generate discussion amongst practitioners and academics. The value of scenarios lies in their ability to challenge our theoretical model and to lift barriers that limit our creativity (Schwartz, 2007). We have identified two main external trends that could affect PSM. The first trend is that IoT can provide significant opportunities to the PSM function to create access to complementary but distant digital capabilities that will be essential to transform a firm's business model. The second trend is that PSM will be itself impacted by the digitalization of business activities. Based on this, we created one scenario that realizes a combination of these two trends. We have structured our scenario around three dimensions: Organization and Processes, Technologies and Systems and Management of People and Skills. Build on that, our aim is to provide new perspectives while

broadening the range of causal relationships that could be further investigated in the field of PSM practices and research.

IoT, Industry 4.0 and digital transformation: some definition

The Internet of Things goes back to Mark Weiser's work in 1988 at computer science lab at Xerox PARC where he formulated the ubiquitous computing vision and described a world, where algorithms are closely embedded in our daily life (Weiser, 1991). Later, in 2009, the term Internet of Things was coined by Kevin Ashton, RFID pioneer and co-founder of the Auto-ID centre at the Massachusetts Institute of Technology (MIT), which created a global standard for RFID (Ashton K., 2009). The IoT is now defined by the International Telecommunication Union as "the global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies. The interrelated evolution of science, technology, business and social practices turns this vision into a reality. Algorithms and sensors offer a system of interconnected smart devices, which enable real time and intelligent communication from man to machine, machine to machine and enterprise to enterprise. IoT is a "general purpose technology" (Rousseau, 2017), it pervades many industries, improves rapidly and generates further innovations. More and more technology building blocks (e.g. smart objects and devices) that can be swiftly interfaced to create open or semi-open systems (Kortuem e.a., 2010, Serbanati e.a., 2011). These building blocks are continuously available at lower price and consume less energy. As the building blocks are increasingly used across all sectors, an increasing amount of data is produced and released and more value springs from connecting unrelated devices and capabilities. Data is becoming the most valuable raw material for the future. In other sectors, products are changed into product/service hybrids and business models are transformed. These changes 'who does what' and 'who gets what' within and across industries and new industry architectures emerge (Jacobides et al., 2006). The Industry 4.0 was coined in a document (Kagermann, 2013) that defined a R&D strategy for the German manufacturing sector. Industry 4.0 is the application of IoT to manufacturing activities as it is based on the concepts of Cyber-Physical Systems (a fusion of the physical and the virtual worlds). The technology enablers for Industry 4.0 include mobile, cloud, big data analytics, machine to machine communication (M2M), 3D Printing, Robotics etc... Meanwhile the 4.0 extension is used in almost all economic fields and for all functions to express the significant changes that are expected to come (e.g. Logistics 4.0, government 4.0, health 4.0, etc.). Industry 4.0 and The Internet of Things are encompassed within the broader digital transformation which was defined as the digitalization of analog machine and service operations, organizational tasks, and managerial processes (Iansiti & Lakhani, 2014) to create value for customers and employees (Solis, 2017).

The Transformation of industry architectures

The following examples show the nature and the extent of the transformation of industry architecture we may experience in the coming years across every part of private and business relationships.

For **retail**, IoT offers opportunities in customer experience, the supply chain, new distribution channels and revenue streams. It allows bi-directional, real time interactions of customers, smart stores, smart products and smart logistics (Gregory J., 2015). IoT is the foundation for achieving "same day delivery" and it could enable companies, such as Amazon, to further

disrupt this sector of activities. Drones are only one device within a much broader web of information resp. Internet of Things and logistic services supported by a rapidly evolving business ecosystem.

For **transportation and mobility**, the emergence of self-driving cars forces automotive OEMs to transform their network of suppliers and partners and to access new capabilities such as batteries, connectivity solutions and mobility services. Mobility-as-a-Service becomes widely accessible as the young generation is moving away from owning a car (Stricker u.a., 2011).The evolution of the industry architecture coupled with the evolution of customer habits will challenge the OEMs dominance in the automotive sector (Attias, 2017). They may find it difficult to keep control over the allocation of profit across the mobility value chain networks.

For **consumer goods**, in recent years, many problems have occurred in the control and protection within food supply chains. As a result, public institutions have given food safety a top priority. In order to stay ahead in this protected and controlled market, IoT may play a significant role on food supply chain's effective information, identification and traceability opportunities. Implementing sensors and identification cross over the value chain, from farming to consuming, creates an interlink of geographic, organizational and functional distributed data networks (Xiaorong Z. u.a, 2015).

3-The IoT architecture as backbone of innovative business models

In order to propose a scenario for the development of PSM 4.0, initially we outline how the IoT affects industry architectures (Figure 1). Therefore, we explore how technology is converted into business value using IoT. The underlying framework combines an IoT architecture (Gubbi J. u.a., 2013) with a business model approach (Dijkman, u.a., 2015).

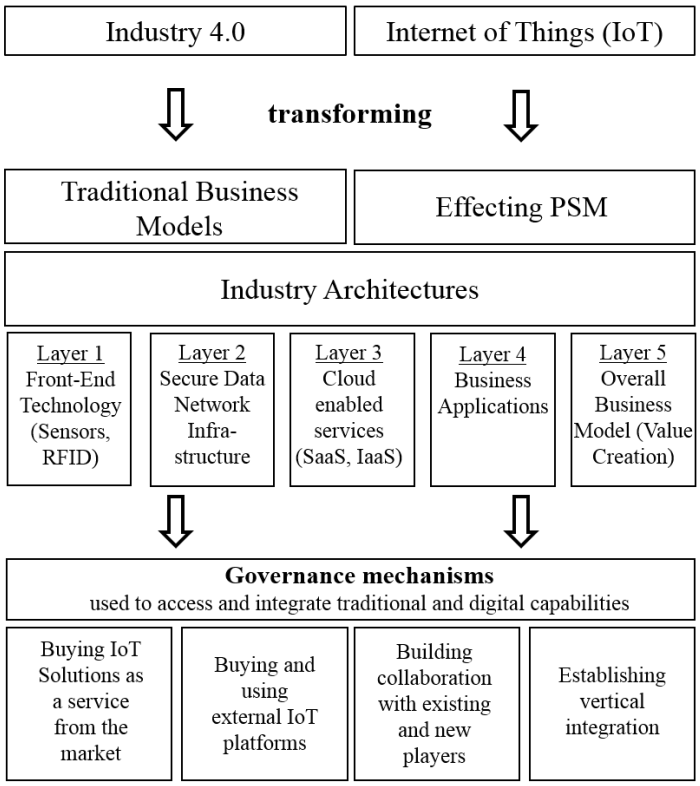

Figure 1: Overview how IoT affects industry architectures

The IoT architecture consists of five complementary layers that transform technology building blocks into new business processes and business models:

- Layer 1 includes front-end technology such as sensors, actuators and RFID embedded in mobile devices or intelligent autonomous objects (e.g. drones, robots, vehicles or smart stores). It creates and processes data anytime and anywhere autonomously. Layer 1 is responsible for the growth of data, conveyed by the Internet in layer 2.
- Layer 2 consists of internal and external communication infrastructures. Networks allow to collect, process, analyse and disseminate valuable information, which were gathered from distributed sources. The required hardware consists of a secure data network infrastructure of scalable nodes (access points, storage) and linkages (wired and wireless).
- Layer 3 represents cloud enabled services that provide SaaS (Software-as-a-Service), PaaS (Platform-as-a-Service), IaaS (Infrastructure as a Service), DaaS (Data-as-a-Service) and more. These software services are available via intranet, extranet or internet. Layer 1, 2 and 3 describe the technologies, which create and process "Big Data".
- Layer 4 encompasses the business applications as customer and supplier relationship management, demand and supply planning and forecasting, SCM risk Management, Track and trace information system, supplier /market scouting and scanning, and more. It improves functional processes and enables new offerings for data driven services. "Big Data" is leveraged to deliver value to customers, employees or other stakeholder. It also improves and accelerate the decision-making process.
- Layer 5 comprises elements of the overall business model. A business model demonstrates how a business creates and delivers value to customers. It also outlines the architecture of revenues, costs, and profits associated with the business enterprise delivering value (Teece, 2009). Technologies grounded in layer 1 to 4 are combined within a business model. Layer 5 therefore transforms information into new competitive advantage.

The proposed IoT architecture shows that companies need to combine traditional and digital capabilities coming from diverse technical and business fields. An IoT architecture is imbedded in a network of partners that provide all necessary building blocks to generate economic value. This integration across one or more layers of the IoT architecture can rely on different types of governance mechanisms used to access and integrate traditional and digital capabilities:

- ***Buying IoT solutions as a service from the market***. Here, an external integrator combines the higher layers of the IoT architecture within its own offerings and business model. Such offerings can then be deployed by the buying firm. For instance, companies can purchase smart logistic services from existing or new suppliers. Airlines purchase aircraft engines by the hour from providers who have extensive capabilities in data led services. Offers come "*as a service*".
- ***Buying & using external IoT Platforms***. Such platforms bring together multiple data service suppliers within a two-sided market. This is relevant for Layer 3 and 4 of the IoT architecture when a broad range of solutions can be aggregated in a platform to match the needs of the buyer. Market places such as iOS and Android allow consumers to access diverse connected devices. Smart factory platforms aggregate and combine diverse data services from multiple sources.

- ***Building collaboration with existing and new players.*** Such collaborations typically aim to combine traditional and digital capabilities to integrate the first three layers of the IoT architecture within a product/service hybrid, an operating model and possibly a business model. The development of Smart Meters for water application by Suez was performed in collaboration with two partners. The three companies worked together on development and sales in order to build an industry standard. Such collaboration can take place between heterogeneous partners where one is a start-up. The Rossignol connected ski for example was developed with PIQ a start-up with artificial intelligence capabilities.
- ***Establishing vertical integration.*** Vertical integration requires to insource and to integrate all necessary capabilities to develop an offering. This can help secure quality and speed while owning the final solution. This creates a path-dependency and requires an important investment, but it can provide a great competitive position, if successful. This is the case of Tesla Motors who, for instance, own their own network of charging stations to make sure that every Tesla driver can charge their vehicle when needed.

The first three modes of governance, presented above, highlight the importance of developing different types of horizontal collaborations. They offer an opportunity for the PSM function to play a key role in the upcoming transformation of their company's business models. PSM can create access to complementary but distant digital capabilities. Furthermore, the digital transformation implies that the roles, tasks, processes and competences of PSM are also affected by the change.

4-Evolving the Purchasing and Supply Management functions

Over the past forty years, the PSM functions in many industries have moved from transactional orientation into a more strategic role (e.g. Weele, Arjan J., Erik M. Raaij, 2014, R. McIvor e.a., 1997). The development of PSM function is often described in evolutionary stages (Schiele, 2007). The PSM Organisation evolves to respond to corporate goals and to react to an ever changing environment. A broad number of Industry partners, in each of our three research streams, expect that the IoT will accelerate and initiate transformations for the PSM function. They see PSM in a unique position to help companies taking advantage of the current industry transformations by gaining visibility on opportunities associated with the IoT.

To summarise our combined findings, we will look at the operational side of PSM stages of evolution as well as at the strategic stages of evolution. Our industry partners recognised that they have to achieve more than a linear extension of what was already done before. For example, the traditional attitude of PSM with a lower level towards risks and standardisation needs to evolve radically to gain advantage from business model innovation. And most importantly, it is not about simply replacing existing practices by new ones but about adding new options. Both, operational and strategic activities will remain relevant and will go through significant evolutions.

On the operational side, the focus of PSM is on efficiency, cost and performance. Our industry partners recognized that IoT and digitalization will transform the way they operate. By further automating the PSM processes, leveraging market-places and data led services from suppliers they expect that internal efficiencies, cost optimisation and further performance enhancement will be achieved. Their challenge is to understand how to set priorities within an uncertain and speculative context.

On the strategic side, the focus of PSM is on innovation, renewal and growth. This is essential to leverage opportunities associated with the Internet of Things. As PSM facilitates access to relevant IoT capabilities, companies are able to redefine their market position and to find profitable spots in the emerging division of labour. Our industry partners expect to help their company either maintain or gain new market shares. On the innovation side, they emphasize the importance of horizontal collaboration as a mean to understand innovation needs and the opportunities so they can help access relevant external capabilities. They also emphasize the need to strengthen their ability to scout for innovative solutions and to strengthen their attractiveness. Early supplier involvement is expected to remain important but to evolve for the forthcoming transformation. Some of our industry partners expect that external partners with IoT capabilities will contribute to transform the core businesses and the business models of their company. Smart meters have been incorporated into the core business of utility companies through collaborations with external partners. Now, they work with external data scientists to build new business models. Here, some of our industry partners see the value of looking well beyond existing suppliers, within the business ecosystem, to identify complementary and distant capabilities of value for the future. Some of them have started to explore how they can work in more agile ways to manage the relationship with innovative suppliers including start-ups and to support early experimentation activities. This section has outlined some of the changes that our industry partners expect. It also establishes the foundation for the scenario presented underneath.

5-A scenario for the transformation of the PSM function

Building on the previous analysis and on the three research streams, we have decided to develop a scenario structured around two hypotheses: First, the IoT can provide significant opportunities to the PSM function to create access to complementary but distant capabilities that will be essential to transform a company business model. Second, PSM will be itself impacted by the digitalization of business activities. We have structured our scenario around three dimensions: Organization and Processes, Technologies and Systems and Management of People and Skills.

Looking at ***Organisation and Processes***, industry experts expect that PSM teams will further diversify their practices to improve their strategic fit between organization and the requirements they face. Most of our industry partners assume that the future PSM organisations become more ambidextrous. While building on digitization opportunities for business-as-usual-situations, they will adopt new ways of working to contribute to a company's transformation. While some processes will be systematic and automatized, others will be more experimental and innovation focused. Classic efforts in terms of standardization will co-exist with flexible and swift forms of work that will respond to the business transformation imperatives.

Processes will be capable of tackling different levels of uncertainty and complexity. The contingency theory (Lawrence & Lorsch, 1967; Burns and Stalker, 1961) suggests that organizations operating in turbulent and uncertain environments are more effective when they use organic, informal, decentralized, organizational structures. Organizations operating in stable environments tend to use more mechanistic, formal and centralized structures to gain efficiency.

In our scenario, PSM needs to do both concurrently. The following framework helps us to reflect this challenge. In line with the contingency theory, the proposed purchasing organization

landscape considers two contingent factors: speed of change on demand side and speed of change on the supply side. The Y axis represents the level of turbulence on the demand side. Environmental turbulence is characterized by high speed change, rapid innovation and growing levels of complexity. As the IoT offers opportunities to rethink offerings and business models, it generates such turbulences. The X axis represents the level of turbulence on the supply side. Environmental turbulence is characterised by high speed of change, rapid innovation and increasing complexity. IoT generates such turbulences on this side as companies need to access and integrate new and distant complementary capabilities. On the bottom left, mechanistic structures will dominate while on the top right we will witness more organic structures. Six approaches have been identified.

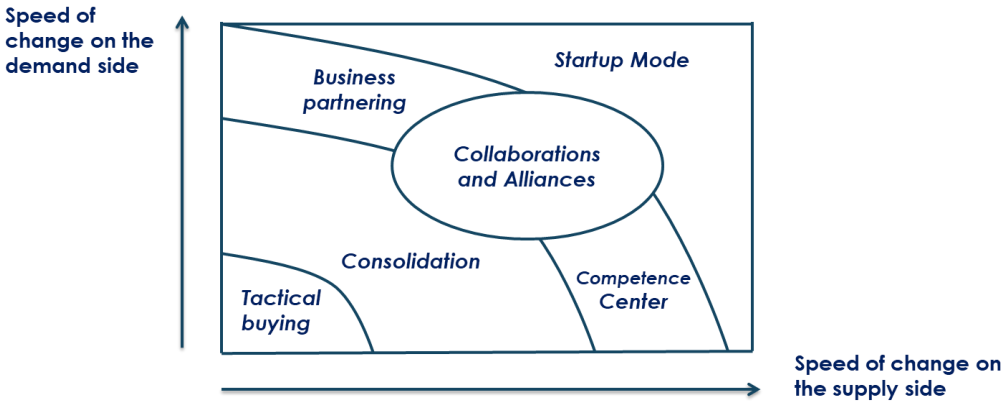

Figure 2: The purchasing organization landscape

I) On the bottom left, the absence of turbulence allows to implement highly *efficient tactical teams*. Using standard processes, they buy standard offerings that match the needs of everyone within the company. Such teams ensure that price and transaction costs are kept at a minimum by using adequate technologies. Tactical purchasing will be increasingly digitized and will be measured by its efficiency.

II) *Consolidation* is performed by Category Management Teams. Their role is to reduce complexity and diversity while maintaining or improving the current levels of performance. Such teams serve the needs of multiple business units, projects, sites or countries. They aspire to consolidate needs on the demand side and to standardize offerings on the supply side. As consolidation is achieved, tactical teams can take over. Buying IoT solutions as a service to cover all needs of a business will fall in this structure. Consolidation focuses on improving the economic performance of the company.

III) *Business partnering* typically arises as an advanced category management practice. Buyers focus on maintaining strong relationships with their business partners to cater for the diversity of needs and the rapid evolutions on the demand side. They do this either through regular direct interaction with them or thanks to a network of contacts within the different business groups. Business partnering is essential when the pace of change is high on the demand side and when the current supplier base can support the business. Suppliers can integrate IoT capabilities to offer easy to deploy solutions that respond to the diverse needs of the business. The purchase of Facility Management solutions typically fall into this category. IoT offers new solutions for managing and servicing buildings effectively. Business partnering aims at offering the best value from the market for the best price to different units with different needs. Performance can be measured by a combination of economic indicators complemented by operational performance measures shared with the business partners such as user satisfaction.

IV) *Competence centres* are an advanced Category Management practice. As turbulences occur on the supply side, buyers continuously keep abreast of the rapid changes that take place in the

broader environment. They advise the business on emerging solutions that could enhance the business performance or offer some differentiation opportunities. As new building blocks for the Internet of Things are put on the market, buyers will need to spot them and develop a clear and early understanding of how they could bring value to the business. Helping the business with taking the best decision at the right time is the role of competence centres. Performance can be measured by assessing the ability to balance risk, cost and innovation.
V) *Managing collaborations and alliances* is required when different building blocks need to be integrated and when architectural knowledge needs to be developed. This is a requirement in many IoT initiatives. Such purchasing teams manage long term relationships with strategic and critical suppliers who bring sometime distant complementary capabilities. The job is about facilitating cross company collaboration by working closely with all parties. This requires the use of the relevant cross company governance mechanisms, joint collaboration frameworks and shared communication tools. The objective is to contribute to the achievement of the business goals shared by all parties. In terms of IoT we saw that one of the governance mechanisms consist of building collaboration with existing and new players which fit within this structure.
VI) Our research also indicates that PSM teams increasingly work in *Startup Mode*. Business projects are handled by small multifunctional teams that combine diverse expertise and operates through rapid loops of visioning, development and validation. They have full freedom to pursue a new idea. When purchasing is involved in such a team, its role is to assemble innovative solutions from external partners that deliver value to the business and to clients. Innovative marketing and sales campaigns that leverage smart packaging or smart displays for instance, can fall in this category. Because resources are limited, it is essential to plan when and how to integrate such teams best possible. From a performance point of view the focus is on time, innovation and final user satisfaction for a given budget base.

The challenge for PSM teams is to develop their ability to use the different structures and approaches presented above concurrently, depending on the level of uncertainty and the nature of turbulences. This requires moving away from the application of a detailed standard process to gain flexibility. The framework presented above is also dynamic in nature. As dominant designs emerge on the demand and supply side, interfaces become more and more standard and PSM can revise its plan and adopt a new structure and approach for a specific purchasing segment.

Looking at ***Technologies and Systems,*** our expert groups indicated that PSM will benefit from being a new technology adopter. Using Big Data, Smart Analytics and the upper IoT layers, PSM can elevate itself to another level of performance. By combining a broad array of internal and external data PSM may act in real-time and become more flexible. Horizontal collaboration and the digitalization of the internal processes help PSM make quick and relevant decisions. PSM systems and tools will be further developed, interconnected and simplified by using bots, natural language and artificial intelligence. We believe that adopting digital and IoT solutions for PSM requires a solid understanding of the problems that are worth solving. Focusing blindly on automating tasks will not be enough. We expect that leading PSM teams adopt broad and forward-looking perspectives on digitalization, so both creativity and end-to-end performance will be unlocked.

Recent publications show that several firms are tapping into the need to harmonize product and financial flows among supply chain partners reaching beyond the traditional horizon of PSM. For such an integrated financial supply chain management cross-functional integration with finance/treasury internally and participating external suppliers is essential (Wuttke et al., 2013a). Such initiatives involve short-term working capital optimizations to leverage credit

rating differentials between OEMs and their upstream suppliers as well as long-term focused lending to suppliers to support their involvement in PSM innovation projects (Wuttke et al., 2013b) or the early stages of joint-product development projects (Wynstra et al., 2010). In order to leverage the full potential of such an inclusive supply chain finance initiative, digital technologies have to be considered in future PSM research. Besides IT techniques such as cloud computing (e.g. Bruque-Cámara et al., 2016), very recently, the blockchain technology and its potential for the field of SCM have been profoundly discussed. It offers a shared, reliable, public register of transactions, that all actors can examine, but no actor can control. As a result, the blockchain offers a virtual room to store value, identities, property rights and agreements. With their ability to keep track of every transaction through a decentralized mechanism of ownership, blockchains offer transparency and accountability of information. Hence, they are likely to affect the sphere of sustainable supply chain management. For example, materials, components and even minerals could be traced back and verified. It could have potentially prevented recent sustainability scandals on conflict mineral or the horse meat scandal from 2013 (Hofmann et al., 2015).

In terms of ***Management of People and Skills***, the adoption of a more diverse set of practices will logically drive PSM to adopt a situational leadership paradigm and to manage paradox effectively (Lewis, Andriopoulos & Smith, 2014). Purchasing teams will be bound together by common ambitions and practices while they need to exploit a diversity of internal capabilities that can be combined and recombined effectively depending of the context. It will be the ability to operate multiple approaches effectively at the same time, which will make the difference for future PSM leaders.

This calls for new skills and extended collaboration capabilities. Depending of the context and of their focus, PSM professionals will work across different structures and approaches. The optimization of work processes by digitalization will lead to a redistribution and change of existing tasks on operational and strategic level. PSM will perform more sophisticated task with less manpower. There will be fewer buyers with a higher level of qualification. PSM teams will increasingly be constituted by small groups of powerful and strategically oriented entrepreneurs. The optimal combination of technologies, processes and people will differentiate leaders from followers. To support the digital transformation PSM has to gain a broader understanding of issues and opportunities related to data, security, IP matters, system integration and business model innovation. Horizontal collaboration will be key in the forthcoming transformation and it requires open collaboration skills. Since technological progress is rapid, the limitation actually lies within the human factor. Therefore, human abilities and ways of thinking should be developed and adapted to the working environment 4.0.

5-Managerial and academic conclusion

As the Internet of Things and Industry 4.0 unfold, we observe that industry architectures are re-invented. For most companies, this means that some suppliers and some existing collaborations need to be abandoned while new ones need to be developed to gain access to valuable distant complementary capabilities. In this context, companies will need to empower PSM to develop their ability to simultaneously explore and exploit new territories and unfamiliar knowledge fields. Integrating different streams of knowledge to generate new offerings, new processes and new business models will be essential. Due to financial constraints and high level of uncertainty, collaborations amongst new players will be a popular vector of change. PSM has a unique opportunity to play here. Therefore, PSM needs to see the IoT as an opportunity. Regardless of whether it acts as an active influencer or as a driving force, the role played by PSM will be

important. PSM leaders need to outline their strategic relevance in this emerging context. The main risk lies in 'doing nothing', 'sitting back and waiting', which will cause PSM to become a follower. PSM leaders can initiate the change and shape a vision that establishes PSM and its ability to leverage IoT opportunities at the core of the strategy. They need to evolve their practices on both operational and strategic matters. They need to experiment with new forms of organisation and develop a culture where failure is accepted as a milestone on the way to success. PSM leaders will also need to ensure that their teams and external partners are properly informed, involved and prepared for the future.

On the academic side, PSM scholars will face some opportunities to broaden their investigations and to address new research questions that relate to PSM and the Internet of Things. This includes studying the transformation of industry architectures, the development of new PSM capabilities and the management of vertical and horizontal collaborations. At the same time, some fundamental questions related to PSM organisation, process and performance will need to be revisited. For instance, we need to study how PSM manages the paradox of being more efficient and innovation focused at the same time. Both practitioners and academics can expect exciting times ahead.

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Preparing for public tendering:

With or without national templates for organizing interaction

Anne-Maria Holma, anne-maria.holma@uva.fi
University of Vaasa, School of Management
P.O. Box 700, FI-65101 Vaasa, Finland

Maren Wiktorin Østensen, maren.ostensen@ntnu.no
Elsebeth Holmen, elsebeth.holmen@ntnu.no
Luitzen de Boer, luitzen.de.boer@ntnu.no
Norwegian University of Science and Technology (NTNU),
Department of Industrial Economics and Technology Management
Alfred Getz vei 3, 7491 Trondheim, Norway

Abstract

The preparation phase of public competitive tendering has for long been acknowledged as important. However, how interaction takes place in this phase has been given little attention. We use explorative multiple case studies conducted in Finland and Norway to study how interactions in the preparation phase can be organized. We rely on process theories (deliberate and emergent strategies) to compare the design of activities in preparation phases, and supply- and knowledge sharing network research to analyze how interaction is organized in the process. We conclude that the interaction can take different forms, and include various types of information exchange.

Key words: public procurement, preparation phase, interaction

Introduction

Public procurement is a multi-objective policy, which simultaneously aims to achieve economic, sustainability, and social goals, and on top of that facilitate innovation to take place through the procurement process (Uyarra and Flanagan, 2010). Interaction with the market in the preparations for public tendering has been acknowledged as important to facilitate innovation and procurement of better goods and services for public use. Early interaction with the market can provide public buyers access to industry knowledge, increase the chances of finding solutions for cost savings, and create an environment of trust that can facilitate realization of opportunities (Uyarra, 2010). However, EU directives and national procurement law restricts the forms of interaction and emphasizes equal treatment of all participants (Arrowsmith, 2014; Lenferink, Taede and Arts, 2013). In this paper, we describe how interaction can take place in the preparations for public tendering in which it can facilitate innovation and lead to better procurements. Thus, our study relates to 'innovation-friendly procurement', which is a term that has been used to denote that, in terms of the procurement process, markets can be expanded and accommodated for new solutions to be developed, or new actors can be invited (Knutsson and Thomasson, 2014, Uyarra and Flanagan, 2010).

In this paper we explore; How can interaction be designed and organized in the preparations of regularly tendered services? Furthermore, how does innovative procurement programs instigated at the national level enable and constrain the manner in which interaction is organized? As a method, we use explorative multiple case studies conducted in Finland and in Norway. The study of interest is, however, how interaction can take place when preparing for competitive tendering in public procurement rather than on country specific differences. Theoretically, we rely on (1) Mintzberg and Waters' (1985) concepts of deliberate and emergent strategies to describe and compare the process of activities in different preparation phases, and (2) supply network and knowledge sharing network research (e.g. Dyer and Nobeoka, 2000; Holmen, Håkansson and Pedersen, 2003) to analyze how interaction takes place during this phase. We conclude that the interaction in the preparation phase can take different forms and include various types of information exchange.

The paper is organized as follows. First, the theoretical framework used for analysis will be presented and discussed. Second follows a discussion of the method applied and a presentation of the empirical material. The third section presents an analysis of the cases. The final section concludes the study.

Theoretical framework – public procurement process and knowledge exchange

In general, the public procurement process can be divided into three stages: the preparation, tender and post tender phase. The preparation phase (also known as pre-procurement or pre-tender phase) is the the process prior to the competitive tendering process where fewer regulations restrict the forms of interaction with suppliers. To describe the activities in preparation phase of public procurement, we use the concepts of deliberate and emergent strategies (Mintzberg and Waters, 1985). Some strategies are intended and intentions are formulated in plans for them to be realized and to set direction and control, often referred to as 'planned strategies'. On the other hand, sometimes strategies emerge more as patterns based on actions and choices taken along a path by employees or other actors, without following predefined plans and intentions, which can facilitate 'strategic learning' (Mintzberg and Waters, 1985, p. 270). Moreover, Mintzberg and Waters (1985) argue that strategies are never purely deliberate or emergent but fall somewhere in between the continuum of the two externalities, and contains some deliberate and emergent elements.

Knowledge-sharing between firms is seen to promote more rich and diverse knowledge compared to the knowledge-sharing within a firm (Hardy, Nelson and Lawrence, 2003), benefiting thus both the buyer and supplier (Dyer and Nobeoka, 2000). Suppliers can possess knowledge that can be useful for the firm, and knowledge-sharing can give firms valuable information (Lorenzoni and Lipparini, 1999). In creating knowledge sharing networks, three dilemmas have to be managed; (i) getting actors to participate and openly share knowledge, (ii) prevent 'free riders', and (iii) share knowledge effectively within the network (Dyer and Nobeoka, 2000). Knowledge can be either (i) explicit or information, and (ii) tacit or 'know-how' (Grant, 1996). Explicit knowledge can be regarded as easily coded and transferable for example in a group setting. Tacit knowledge is encoded and inherent knowledge in the firm, and it is transferred through closer and more intensive interaction in small groups (Dyer and Nobeoka, 2000). Moreover, organizations learn by collaborating with other organizations and by sharing tacit information (Kogut and Zander, 1992). Regular communication, interpersonal connections and commitment help to share knowledge and create shared perspectives (Granovetter, 1973). Prior studies have shown that informal socialization tactics, such as face-to-face communication, are important to the level of knowledge sharing within collaborative product development teams (Lawson, Petersen and Cousins, 2009) and strategic alliances (Oxley and Sampson, 2004). Barriers for knowledge-sharing and collective learning may exist when there are differences in norms, values, technical language and fundamental concepts between individuals or organizations (Rashman, Withers and Hartley, 2009). In public procurement context, competition between public organizations or punishments for failure may inhibit knowledge-sharing (Vince and Saleem, 2004). However, relatively little research has been devoted to the ways by which public organizations create, transfer, share and apply knowledge (Rashman et al., 2009).

Method

To show how interaction can be organized in the preparation phase of public procurement, we have followed an embedded multiple case study design consisting of four cases. Two of the cases are taken from a Finnish context, where no innovative procurement program has yet been established at the national level. Two of the cases are taken from a Norwegian context where a national innovative procurement program (NP) was set up more than a decade ago. In empirically describing the cases, we aim to present different activities in the preparation phase and capture how the interaction between procurers, suppliers and other parties can take place.

We adopted an exploratory approach. The Finnish study (Case 1 and Case 2) was a part of a three-year long research project (2014-2017). The main data sources were in-depth semi-structured interviews with potential suppliers and unstructured interviews with Procurement Unit (PU) that was responsible for the municipalities' tendering. Furthermore, we observed interactions between the suppliers and the PUs and studied several documents related to the tendering, for example, the initial and final RFQ, and material prepared for the interactions with the potential suppliers. We arranged also workshops with the personnel involved in the procurements.

The Norwegian study (Case 3 and Case 4) was part of a one and a half year long research project (2016-2017). Data was collected through semi-structured interviews with representatives from the procurement and function units responsible for the procurements, potential suppliers and a sub-supplier. Further, a number of different documents related to the preparation phase and competitive tendering was studied (i.e. invitations to information session, RFQ etc.). Workshops were held with the representatives from the procurement and function units, the NP and researchers to discuss and have common understanding of the procurements.

Case descriptions

In all the four cases, the value of procurement contract exceeded the EU-thresholds, and competitive tendering was organized according to the EU Directives and national law of public procurement, and applying the open tendering procedure.

Case 1 (*Care catering*) and Case 2 (*Hospital Catering*) concern a Finnish municipality's two different catering services procurements. Collective supply contracts are used in all the Municipality's units. In 2014, the Municipality started an outsourcing process of all its catering services, which previously had been provided in-house. *Care catering* concerned meal deliveries for special groups, i.e. persons with disabilities, senior citizens and drug addicts. Preparations started in the autumn 2014, and the Contract Notice and Request for Quotation (RFQ) were published in the spring 2015. *Hospital catering* involved municipality's hospitals, including catering services for patients, staff restaurants, and hospital cafeterias. The preparations started in the autumn 2015, and the Contract Notice and RFQ were published in the beginning of the year 2016. The PU was authorized to take care of the preparations for the tendering. The intended duration of both the contracts was three years. In both the cases, the Welfare unit was the customer, which, in turn, is responsible for providing catering services for its customers, i.e. hospitals and care homes. The end customers were the inmates, patients, visitors and stuff in the hospitals and care homes.

Case 3 (*Ferry service*) and Case 4 (*Education service*) concern two county municipalities' procurements of services. The *Ferry service* involved a procurement of ferry transit services with a two-year contract. Normally, the contract duration are eight to ten years, but the procurement was adjusted for a future procurement of two sections in one tender. The preparations for tender started in autumn of 2014 and the RFQ was published in the start of 2015. The county municipality was the customer and is responsible for the planning of local and regional schedule for transportation and in this case, a county municipality owned organization (CMO) performed the procurement based on a mandate issued from the county. The end customers were travelers using the ferry transit service. The *Education service* concerned procurement of follow-up services for young people with risk of falling out or fallen out of upper secondary education. The county municipality had not offered a similar service earlier. The preparations for tender started in late summer 2015 and the RFQ was published late autumn 2015. The preparations and procurement was performed by a project group (PG) consisting of representatives from the follow-up service and procurement unit, and the end customers were young people fallen out or with risk of falling out of upper secondary education. In the *Ferry* and *Education services*, the NP was involved and suggested to use a designed process of activities in the preparation phase.

Activities in the preparation phases

The *Ferry* and the *Education services* followed a designed process of activities proposed by the NP. In the *Care* and *Hospital caterings*, the processes were inspired by other tenderings. All the four preparation phases started with internal service specification and needs assessment, and a draft of the specifications were developed in advance of the market dialogue activities. Catering services had earlier been provided by a limited company owned by the municipality. Therefore, the internal needs assessment was extensive. Different interest groups were engaged: the PU engaged the Welfare unit, and several other internal units. In addition, a market search was done to map potential suppliers. The *Hospital catering* preceded the *Care catering*, and was conducted by the same PU. In the *Education services* as well, the internal needs assessment was extensive and long.

In all the cases, information sessions were organized, where the suppliers were informed about the forthcoming tendering and the tentative plans regarding the content of the service. In the *Care* and *Hospital caterings*, the organizer was the PU, and the sessions were open for all interested actors. An additional aim for these sessions was to provide the suppliers an opportunity to create relationships so that also the small suppliers would be able to participate the tendering. However, no partnering relationships were formed. In the *Ferry service*, the information session was organized by the CMO, and the NP, a municipality, and the shipping association attended, in addition to the potential suppliers and one sub-supplier. For the *Education service*, the information session was organized by the PG, and potential suppliers, the NP and head of education attended the session. After the information session, several suppliers started talking to one other about delivering a solicited offer.

In the information sessions, the potential suppliers were invited to book a time for a face-to-face technical dialogue in all the four cases. In all the technical dialogues, confidentiality was underlined, and all suppliers were given equal amount of time. The issues discussed concerned mainly technical details. In the *Care* and *Hospital caterings*, the customer was invited to these dialogues; however, the customer was present in three dialogues out of five and in the *Hospital catering*, there was no customer representation.

The feedback from the information session and technical dialogues were used to improve the RFQ and to finalize the tender documents. As a final activity, the RFQ was distributed for comments in writing and suppliers could comment in writing in two of the cases: *Care catering* and *Ferry service*. The purpose of this activity was to clarify aspects in the specifications. Figure 1 shows the timelines of the activities in the preparation phase for all the cases.

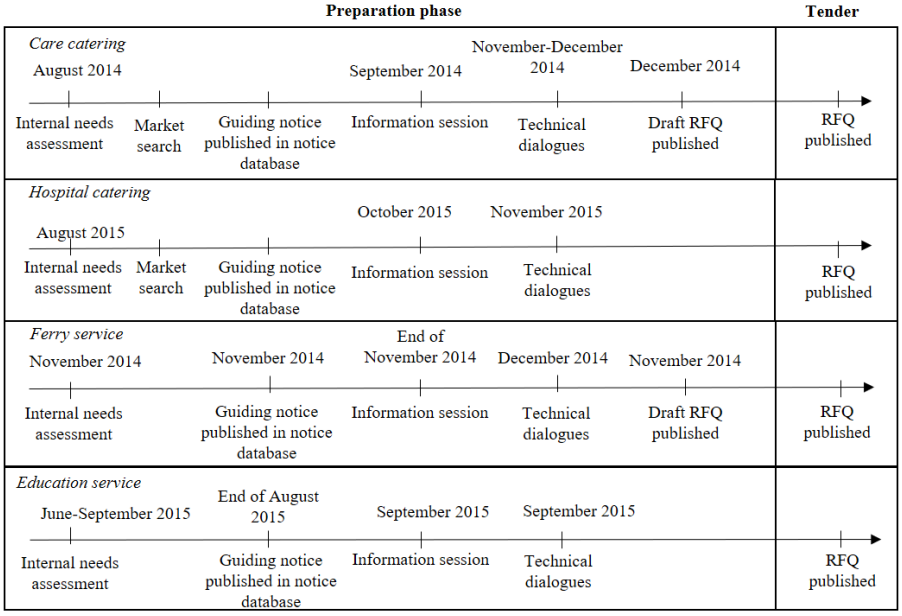

Figure 1: Timelines of the preparation phases

Analysis of interactions and processes

This section analyses the results of each case. The first issue addressed for each case is how interaction was organized and designed, and the type of information exchanged. The second issue addressed is how the process of activities in the preparation can be viewed as emergent or deliberate.

Case 1 – Care catering

The *Care catering* procurement consisted of one internal activity and three activities to facilitate interaction with potential suppliers. The interaction at the information session reflected one-way explicit information exchange of technical information from the PU to the potential suppliers about the forthcoming tender. The PU expected the suppliers to comment about the plans but due to presence of other potential suppliers, none of the suppliers asked or commented on the information that were given, which demonstrates the difficulties in creating networks of relationship where knowledge could be shared openly, as noticed by Dyer and Nobeoka (2000).

In the technical dialogues, the PU and suppliers had an opportunity to interact on a face-to-face basis and to exchange information without the suppliers' competitors' presence. The information was mainly related to the details of the purchased services and goods, i.e. the information exchanged was explicit knowledge. In addition, the buyer learned about the suppliers´ resources and capabilities, and both parties equally recognized the importance of meeting face-to-face and coming to know one another. The dialogues were well prepared with pre-readings that were sent to the suppliers beforehand and the suppliers could prepare. Furthermore, longer time was allocated to the dialogues (1,5 hours) and the suppliers perceived that the dialogues created better conditions for potential cooperation. However, a barrier for the buyer for deeper interaction and sharing implicit knowledge was the required equal treatment of the potential suppliers. For the suppliers, this requirement of equal treatment caused the fear of knowledge spillover to competitors. Therefore, the technical dialogues did not help in developing the tender specifications, and the dialogues resulted only in minor modification in the preliminary RFQ, for example, correcting some mistakes in the calculations. The most significant change was mitigating the sanctions related to the providers' expected performance.

When the RFQ was distributed, the comments were used to make the last adjustments prior the announcement of the competitive tender. The information exchange was written and two-way. The suppliers found written commenting difficult and unproductive. There was a time pressure with tight deadlines and reading took a lot of time due to the length of the RFQ. However, some faults were corrected with the help of the suppliers' comments.

Moreover, the process of activities in the preparation phase of the *Care catering*, the activities did not follow a predefined path of activities proposed by an external actor. The PU followed mainly the same practices that have been used in the context of other large tenderings in the municipality, for example in facilities tendering. Hence, the process of interaction activities can be regarded as an emergent process with hints of deliberate elements as the PU was inspired by other large tenderings.

Case 2 – Hospital catering

In the *Hospital catering*, the interaction at the information session was one-way exchange of explicit of technical information about the forthcoming tender from the PU to the potential suppliers. As in the *Care catering*, the PU expected the suppliers to comment but none of the suppliers asked or commented on the information given. In the technical dialogues, the information exchange had the same features as in the *Care catering* case. However, the *Hospital catering* preparations were featured by tight timetable and lack of sufficient resources. The technical dialogues lasted for one hour and the suppliers were not given pre-readings before the dialogues. As in the *Care catering*, for the buyer a barrier for deeper interaction and sharing implicit knowledge was the required equal treatment of the potential suppliers. For the suppliers, this requirement of equal treatment caused the fear of knowledge spillover to competitors (Dyer and Nobeoka, 2000). Therefore, the dialogues resulted only in minor modification in the preliminary RFQ, for example, correcting some mistakes in the

calculations. The most significant change was mitigating the sanctions related to the providers' expected performance. During a later phase when the service was implemented, it was noticed that the commenting of RFQ would have been important, because several misunderstandings and lapses of memory were discovered. These faults had to be corrected, which prolonged the implementation and impeded daily deliveries.

The preparation phase in the *Hospital catering* was emergent with hints of deliberate elements. as it was not based on a predefined process model but the PU followed the same procedures as in the *Care catering*.

Case 3 – Ferry service

In the *Ferry service*, the interaction at the information session was one-way explicit information exchange with traces of dialogue. Information was exchanged from the CMO, the NP and municipality to the potential suppliers and the shipping association. The traces of dialogue were apparent through the questions some suppliers asked, however, these were general clarifications. The attending suppliers reported that the information session made it easier to understand the need and requirements for the tender, since the duration of the contract was shorter than normal ferry transit contracts.

The technical dialogues involved face-to-face explicit information exchange between the CMO and the suppliers, where technical details about the forthcoming tender was discussed. Moreover, the suppliers were in the technical dialogues more open to exchange information. The suppliers experienced that the technical dialogues gave them more insights about the risk and uncertainty of the forthcoming tender in which helped them price and develop the tender documents more precise when the RFQ was published. The CMO got inputs from suppliers on several aspects regarding the specifications in which also resulted in changes e.g. time of departure of ferry was changed to time of arrival based on inputs from the suppliers. In addition, the CMO got more insights to the suppliers' capacity and views on the ferry service, which was valuable for future tenders.

The preparation phase in the *Ferry service* followed a processes of activities proposed by the NP. Thus, the preparation phase can be regarded as a deliberate process of activities. However, the NP proposed what the content in the different activities could be but the CMO was responsible for what was done.

Case 4 – Education service

The interaction at the information session in the *Education service* can be regarded as one-way explicit information exchange with few traces of dialogue. There were very few comments from the suppliers, but the PG was prepared for this as the NP had informed them in advance. The PG experienced the information session as valuable because they got to inform suppliers about the need and aim of the service. The information session also resulted in establishments of relationships between suppliers.

The technical dialogues involved two-way information exchange between the PG and the suppliers, and the suppliers presented a proposal for the service. Several suppliers attended the technical dialogues in groups of two or three as a result of the relationships established after the information session. This was to draw on each other's strengths and due to suppliers' capacity limitations. The input from the suppliers were perceived as valuable by the PG as it gave them insights to suppliers capability of providing the service and inputs on the specifications and service. The suppliers experienced that their feedback was used to improve the specifications e.g. adjusting the economic model for payment. Based on the information session and technical dialogues, the PG felt that it was created a 'sense of community' for the

need and aim of the service, meaning that the PG and suppliers were working towards the same goal.

The *Education service's* preparation phase followed the designed process model proposed by the NP and can be regarded as a deliberate process, but with hints of emerging elements. The emerging elements came to light by that not all the activities the NP proposed was used in the preparation phase i.e. the written procedure.

Cross-case analysis

In this section, we recognize that interaction during the preparation phase takes different forms (or framing modes, see Holmen et al., 2003) and different actors are involved. We focus on how information flows and forms of interaction in the different activities.

One-way information exchange

Different actors were involved in the activities of the four preparation phases. In all the cases, the information flow in the information sessions were characterized by one-way exchange with traces of dialogue in the *Ferry* and *Education services*. The public buyers expected the suppliers to comment about the plans but due to presence of other suppliers, some comments were only raised in the *Ferry* and *Education services*, and none in the *Care* and *Hospital caterings*. This demonstrates the difficulties in creating networks of relationship where knowledge could be shared openly, as noticed by Dyer and Nobeoka (2000). The absence of interaction and dialogue between the public buyers and suppliers at information session can be linked to sharing information in plenary sessions with the risk of revealing business secrets and lack of trust. This is also illustrates the 'free rider' problem in knowledge sharing networks (Dyer and Nobeoka, 2000). Creating mutual trust in the preparation phase is not consistent with the competitive situation the suppliers are part of in public procurement and, therefore, it is difficult to create trust-based and fruitful interaction at the information session.

For the *Care* and *Hospital caterings*, the PU was the only actor informing suppliers at the information session, while in the *Ferry* and *Education services*, other actors also informed the suppliers. While the interaction set-up in *Care* and *Hospital caterings*, can be regarded as 'one-to-many' i.e. PU to many suppliers, the interaction was organized as 'many-to-many' in the *Ferry* and *Education service* i.e. public buyer and other actors to suppliers. Figure 2 illustrates the forms of interaction at the information sessions. The attendants at the information session for the *Care* and *Hospital caterings* were the PU personnel and potential suppliers, while in the *Ferry* and *Education services* other actors also attended i.e. the NP, shipping association, head of education etc. In the *Care* and *Hospital caterings'* preparations, the suppliers noticed the absence of the customer, and they would have preferred discussing some issues, for example logistic details, directly with those dealing with the daily practices. In the *Ferry* and *Education services'* preparations, the NP supported the CMO and PG in the preparations for the information session and technical dialogues.

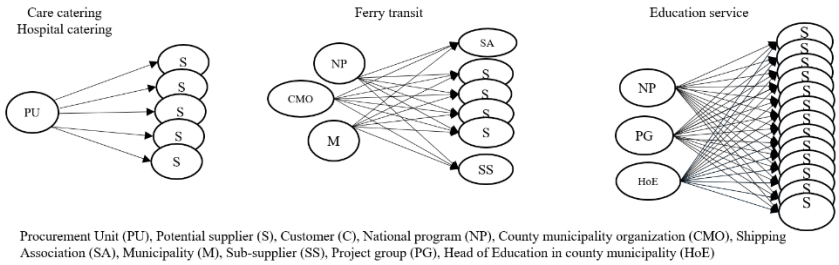

Figure 2: Information exchange at information sessions

Two-way information exchange

In the *Care catering* and *Ferry service*, two-way information exchange took place at the technical dialogues and in the written procedure to comment the RFQ. The form of set-up for the technical dialogues in the *Care catering*, were 'one-to-one' in two dialogues i.e. PU to one supplier and 'many-to-one' in three dialogues i.e. PU and customer to one supplier. In *Ferry service*, the technical dialogues were organized as 'one-to-one' i.e. CMO to one supplier. Moreover, more detailed information was shared at the technical dialogues since competitors were not present, but tacit knowledge was not shared.

In the *Hospital catering* and *Education service*, two-way information exchange were organized at the technical dialogues. Due to limited time, the written procedure was not done in these preparations. In the *Hospital catering*, the interaction was organized as 'one-to-one' i.e. PU to one supplier. In the *Education service*, some suppliers formed relationships after the information session and participated the technical dialogues together. This was also an additional aim in the *Care* and *Hospital caterings*, but no relationships were formed. The interaction in the *Education service*, reflected a 'one-to-many' set-up in three dialogues i.e. PG to many suppliers and 'one-to-one' in two dialogues i.e. PG to one supplier. Figure 3 illustrates the forms of interaction in the four cases.

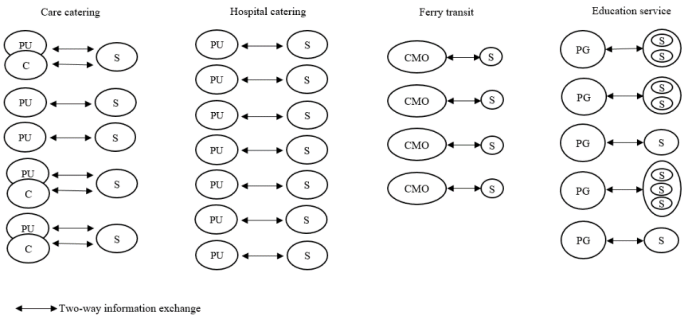

Figure 3: Information exchange in technical dialogues

Discussion/conclusion

From the analysis of the cases, we conclude that the process of activities in the preparation phases are similar with some variations. However, the forms of interaction, outcomes of the preparation phase, and how the processes of activities were instigated, differs. In terms of the processes of activities, information sessions and technical dialogues were used in all the cases, while the written procedure were used in the *Care catering* and *Ferry service*. In the *Care* and *Hospital caterings*, the suppliers were mapped prior to the information session, aiming to get as many potential suppliers as possible to tender. This was not done in the *Ferry* and *Education services*. As it follows from the analysis, the activities of the preparation phase can be regarded as deliberate – following a predefined model of activities instigated by an external actor, or emergent – not following a predefined model for activities. However, the deliberate processes shows hints of emergent elements as seen in the *Education service* where the written procedure was not done due to time pressure. The vice versa is also the case for the emergent processes, containing deliberate elements, shown in the *Care* and *Hospital caterings*. This follows Mintzberg and Waters' (1985) argument that processes cannot be completely deliberate or emergent.

Moreover, the forms of interaction in the activities and outcomes of the preparation phases for the specifications differs. The interaction form in the information sessions, were organized as 'one-to-many' and 'many-to-many', involving one-way information exchange in informing about the service needs and procurement plans. Further, the technical dialogues opened up for more interaction and were organized as 'many-to-one', 'one-to-one', and 'one-to-many', which illustrates different forms of interaction . Furthermore, the outcome of the preparation phases

illustrates differences in how feedback from potential suppliers were used to improve the specifications. In the *Care* and *Hospital caterings*, the feedback from suppliers was mainly used to mitigate sanctions, and the specifications for tender were very detailed. On the other hand, in the *Ferry* and *Education services*, the feedback from the suppliers were used to improve the specifications in order to make it possible for suppliers to deliver on the tender based on their capacities. A possible explanation for this could be because the *Ferry* and *Education services'* preparation phases followed a predefined model by the NP, and the NP assisted the public buyers in the preparations contributing with expertise. The role of the NP resembles what Edler and Yeow (2016) describes as intermediaries in which the intermediary could help to tackle some of the known procedural and capability failures in public procurement of innovation.

From the analysis, we see that interaction with the market in the preparation phase is not only used in relation to innovation and when procuring new goods and services. Interaction activities in the preparation phase can be used to get inputs from suppliers on ways of delivering the good and get insights to suppliers' capability and capacity in delivering the tender, when the public buyer is outsourcing a service which earlier has been provided inhouse, or when the service is new to the public buyer.

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Cooperative purchasing in a nightwatch state

Ilkka Ikonen and Juha-Matti Lehtonen
National Defence University,P.O. Box 07,00861 Helsinki,Finland
(+359299530488, ilkka.ikonen@mil.fi) and (+359299530484, juha-matti.lehtonen@mil.fi)

ABSTRACT
The aim of this paper is to explore how cooperative public purchasing is organised within the context of security organisations.The literature review outlines the different forms of cooperative purchasing, the context of public purchasing and the agency theory. The empirical part identifies the different forms of cooperative purchasing and the incentives of cooperation through eighteen interviews with purchasing professionals. This article contributes to the current state of scientific knowledge on cooperation purchasing and the enhancement of cooperation between different purchasing organisations. This is accomplished by demonstrating the rationale of choosing different forms of cooperative purchasing.

Keywords: cooperative purchasing, public purchasing, security

INTRODUCTION

The economic situation in Europe, and especially in Finland, has led to extensive budget reductions. Security organizations in particular with fewer resources had to response to incidents like the crisis in the Ukraine, the immigration crisis and the increasing level of terrorism. Even though the appropriations distributed to the Finnish Defence Forces, the Police of Finland and the Finnish Border Guard have nominally increased by 20% in 2007–2017, their level has, however, remained relatively unchanged when adjusted for inflation. At the same time salary costs in the public sector have increased 16% quicker than the rate of inflation. During the past ten years, the number of personnel in the Finnish Defence Forces has decreased by 23%, in the Finnish Border Guard by 13% and in the Police of Finland by 12% (Ministry of Finance, 2007 and 2017).

In an effort to meet economic demands, the Finnish Government has focused on the development of procurement activities, such as collaborative procurement, as means to respond to the challenges driven by fewer resources and changes in the security environment. One way is to collaborate with other similar organisations beyond national borders, such as purchasing defence material from the NATO Supply and Maintenance Agency. Another is to collaborate with other public organisations, such as security organisations. Collaboration with the private sector, in the form of a private-public partnership could also be fruitful. Finally, the need of multiple purchasing of the same material could be eliminated altogether by appointing an official responsible for each security material, who will be able to provide administrative assistance that will enable material borrowing across security organizations within country.

Finland's public procurement strategy aims to expand collaboration and centralise procurement (Ministry of Finance, 2009). The Finnish Government has defined in 2006 the products and services that must be acquired through a centralised procurement process that includes electricity, fuel, office furniture, regular IT equipment, expert services, mobile

phones and occupational healthcare services. In accordance with the procurement strategy, Hansel Oy, a central procurement unit, is responsible for arranging the bidding processes for commodity-type products and services. Its activities, as a central procurement unit, are defined in the legislation In 2016, the Ministry of Finance proposed the monitoring of the consumption of cooperatively procured products and services and promoting the overall use of cooperative procurement in line with the goals set to be adopted as common goals for public procurement (Ministry of Finance, 2016).

This article discusses the opportunities for collaborative procurement between Finnish security and rescue organisations. The article also evaluates different forms of cooperation between security authorities including centralised procurement through Hansel Oy. The aim is to answer the following questions:

- What types of items are suitable for collaborative or centralised procurement projects in the context of public purchasing and what are not?
- How collaborative procurement of Finnish security organisations is currently organised and how it is reflected through theory?

There are quite a few differing definitions of cooperative purchasing. For example, a narrow one by Tella and Virolainen (2005: 162) "independent organisations that pool their purchases in order to achieve various benefits" and a broad one Schotanus and Telgen (2007: 53) "the cooperation between two or more organisations in a purchasing group in one or more steps of the purchasing process by sharing and/or bundling their purchasing volumes, information and/or resources". In this article, we follow the broad definition where cooperation in its simplest form may only involve the exchange of information.

The article presents the background of public procurement and its legal context as well as the different types of items. The Agency theory is discussed in order to highlight the conflicting goals between the principal and the agent and describe the governance mechanism that limits the agent's self-serving behaviour as suggested by Eisenhardt (1989) on the public procurement and collaboration. It continues with the different forms of organising collaborative procurement following the Schotanus and Telgen (2007) model. Then the interview results are presented and the article concludes by drawing conclusions and discussion of the results

LITERATURE REVIEW

Public procurement

Public procurement in Finland is governed by the Act on Public Contracts (1397/2016), which is based on the EU public procurement directive 2014/24/EU and the Act on Public Defence and Security Contracts (2011/1531) consistent with the EU defence and sensitive security procurement directive 2009/81/EC. According to these acts, purchases that exceed a specific monetary value threshold must generally undergo a bidding process as defined in the legislation. However, the national security derogation in article 346 of TFEU leaves the trade of military material as well as the disclosure of information, essential to security interest, outside the jurisdiction of the EU. Because of this national security derogation, the defence procurement directive has not been extensively used. European Commission (2016) estimates that only 8.5% of defence procurement was carried out on the basis of its provisions.

According to Schapper et al. (2006), public procurement has three types of principal goals. In addition to the most affordable results and effective management, these goals include the maintaining of general trust in public procurement activities through transparency, equality and sustainability and the aiming to fulfil other general political goals, such as regional balance and eco-friendliness. For example, maintaining general trust, through openness and monitored use of assets, is possible by means of laws and decrees. This leads to different procedures compared to a situation where only affordability and efficiency are required. The regulatory system, which is also called bureaucracy, is not in line with the goals of flexibility and efficiency.

The Kraljic (1983) model is widely used in procurement management to divide the purchases of industrial companies into four categories according to the importance of each product and the risk of availability. These categories are strategic, bottleneck, leverage and non-critical items. The procurement volume should be regarded as a criterion for importance, in the simplest sense, and the lack of alternative suppliers or substiute products can be regarded as an availability risk. Different goals and operating methods can be applied to various categories. Van Weele (2005) recommends supplier cooperation for high-volume products and products with an uncertain availability but, if the risk is low, a strict bidding process should be used. Correspondingly, routine products of a low volume and risk should be procured effectively with minimal administration but, if availability is uncertain, it is important that availability is secured. According to Schapper et al. (2006), public procurement is divided, in most countries, into processes involving a low unit price and a high volume and into processes involving a high unit price and a low volume (e.g. investments). Of the five main procurement groups defined by Iloranta and Pajunen-Muhonen (2012), this definition corresponds to investments and indirect procurement, as the other groups, such as intermediated items or production purchases, do not exist in the public sector. According to them, these different groups differ from one another in terms of goals and operating methods. The fundamental idea of the Act on Public Contracts is competitive bidding which is automatically assumed to reduce prices (Kalima et al., 2007). However, the Kraljic model recommends that bidding processes are only applied to high-volume and low-risk products. Even though controlling the availability risk is not necessarily a central factor in public procurement for security organisations, at least in terms of regulation, it is important to deal with high-volume products with low unit prices. With regard to these, the aim is to reduce the amount of administrative work. Iloranta and Pajunen-Muhonen (2012) define these as indirect purchases that, according to them, are often decentralised and poorly monitored.

Agency theory

The core of agency theory is the differing goals of the principal, who contracts the work to be performed by the agent, and the agent who does the work and receives a reward. This leads to issues involving lack of effort by the agent (i.e. moral hazard), misrepresentation of ability (adverse selection), because of the principal's inability to verify ability, and the actual effort or outcome (Eisenhardt, 1989). There are ways to mitigate these challenges through e.g. procedural control (Soudry, 2007), monitoring, bonding (i.e. sanctions, punishment), oversight (Yukins, 2010) and economic incentives to align interests of the principal and the agent through outcome-based rewards (Eisenhardt, 1989).

Agency theory has its origins in the organizational works of Mitnick and the economical agency theory developed by Ross both published in 1973 (Mitnick, 2013). Since then there is

an abundance of applications of agency theory within different contexts. For example, Fayezi et al. (2012) found 19 papers in the field of Supply Chain Management. Flynn & Davis (2014) identified the substantial role of agency theory in public purchasing, even though they concluded that public purchasing in general has been under-theorized. Agency theory, as McCue and Prier (2008) suggest, may shed light also on cooperative public purchasing in particular.

Cooperation means mutual effort for a common goal and implies mutual benefits. In agency theory, however, the agent receives a reward that might be based either on behavior (e.g., salaries, hierarchical governance) or outcome (e.g., commissions, market governance) (Eisenhardt, 1989). The meaning of cooperation is the opposite to being vertically compelled in cooperative public purchasing, where mutual benefits would flow to independent parties deciding to cooperate i.e. have enough independent power to make decisions concerning participation. McCue and Prier (2008) recognize multiple layers of agency (the government, purchasing units, individual purchasers) involved in any public purchase and that vertical agreements (or contracts) are different from horizontal public purchasing agreements. The goals of purchasing units could be at cross-purposes so that there may be times when cooperative public purchasing is not mutually advantageous (McCue and Prier, 2008). Mutual benefits imply a win-win relationship between cooperating parties (e.g. purchasing units), at least ex-ante. A win-win relationship may not be assessed in each cooperative transaction when taking a long-term relationship view, although case-by-case assessment may dominate. Maverick buying, as discussed by Karjalainen et al. (2009), is also an agency problem where a purchasing unit or a purchaser is seen as an agent that is compelled by a superior principal, but because of hidden information, compliance cannot be fully monitored by the principal, leaving the door open to maverick buying i.e. noncompliance. However, this is not true independence to make purchasing decisions, but goal incongruence between a principal and an agent.

In cooperative public purchasing, multiple parties arise both from, by definition, more than one principal in cooperation, and multiple levels of agency in public administration. Levels of agency in public purchasing make cooperation more complicated than in the private sector where two private enterprises are independent while in the public sector, different purchasing units of a state are subject to national government. Only the participation in intergovernmental cooperations, such as NATO Support and Procurement Agency, is from this viewpoint, comparable to cooperations between private enterprises. McCue et al. (2015) state that problems of common agency, referring to multiple and conflicting principals utilizing a common purchasing agent, appear to be unrecognized in the current literature. The national government level may set up a purchasing vehicle, such as Hansel in Finland, charged with the task of procuring some items for all purchasing units. This kind of arrangement can still be viewed as purchasing cooperation in Schotanus and Telgen (2007) model but not as cooperation between independent units, as it is mandated by the principal, the Finnish Government. As the level of application ascends from two to three parties the number of articles investigating the identified relationship variables descends, indicating a gap in the literature (Fayezi et al., 2012).

Organisation of cooperative procurement

When a purchaseing unit transfers purchase agreement to another using the same definitions, terms and conditions or carry out a procurement process on behalf of another without the other party having any impact on the specification or terms and conditions, is this form of

cooperation called by Schotanus & Telgen (2007) as **hitchhiking**. This form of cooperative procurement means that one organisation is responsible for the entire procurement, but other joining organisations are able to report their volumes for the specific project. Hitchhiking can be an effective way to benefit from low prices without needing to carry out any procurement-related work. However, the party preparing the agreement has no direct incentives, unless the hitchhikers pay compensation or significantly increase the total volume. Considering the recuirements of procurement directive, it is sufficient, to state that other procurement units, specified in the procurement notice, may be involved in the final agreement based on their offer (European Commission, 2008).

Cooperative procurement may be carried out by a third party. To cover the costs of the third party, the participating organisations can collect membership fees. As the participants cannot have much impact on the implementation of cooperative procurement or the specification of the product Schotanus & Telgen (2007) call it **bus service**. According to this option, the participants have few cooperating and influencing opportunities, which also allows the number of participants to be high.

Responsibilities for cooperative procurement can also be implemented on the basis of the lead buyer concept. Schotanus & Telgen (2007) refer to this form of cooperative procurement as a **carpooling**. This cooperative procurement method cannot be applied to one-time procurement or a single item because there must be many products and the operations must be continuous, at least to some extent, so that the responsibilities for different product groups can be distributed among participants. This requires a higher amount of administrative work than the bus service and hitchhiking. Each participant is able to increase their expertise within their own area of responsibility, but they will, correspondingly, lose it in other areas.

For large and significant project procurement the procurement unit might not even be able to carry out such procurement without the cooperation of other parties with similar needs. Schotanus & Telgen (2007) refer to this type of cooperative procurement as a **convoy**. Here, the expertise of all different parties can be utilised in cooperative procurement. This means extensive cooperation and many negotiations, for example, when specifying the requirements and selecting suppliers. For a one-time project, it can be difficult to build trust and evenly distribute responsibilities.

When all parties participate and have a shared impact on many or all procurement phases Schotanus & Telgen (2007) call this kind of cooperative procurement as an **F1 team**. Responsibilities and influencing opportunities can be defined in the agreement but, if there is strong mutual trust, a formal agreement may not be necessary. Cooperation involves the specifications of technical requirements and commercial aspects as well as testing and acceptance, even if purchase agreements are often separate. Some functions may be outsourced to parties that do not take part in the product procurement process, for example, the preparation of commercial agreements. Unlike in carpooling where procurement of each product group is a responsibility of one participant, in an F1 team participant organisations are involved in the procurement process of a same product, just as in a convoy. Compared to a convoy, an F1 team operates continuously, which enables a more permanent and thorough form of cooperation than a project organisation.

Schotanus & Telgen (2007) present how different forms of cooperative procurement can be placed in a matrix where one dimension presents the number of shared activities and the other dimension shows the intesinveness of participation in group's activities by individual

members. Activities cover, for example, the exchange of information, the definition of requirements, the selection of suppliers, the preparation of agreements and the shared use of personnel resources. Intensiveness refers to the depth and intensity of cooperation, such as number of benefits, shared meetings, influencing opportunities and commitment.

Schotanus & Telgen (2007) suggest that the model is beneficial especially during the initial phases of the cooperative procurement group, when it can be used to pick the best mode of cooperation with respect to the operating environment. However, the selected form of cooperation influences the depth and intensity of cooperation and the number of shared functions are influenced by the mode of cooperation and they are not merely independent environmental factors. The product is not part of the model, even though project-type procurement includes much more work and, therefore, offers more opportunities for shared activities than procurement of standard products. The European Commission (2008), in contrast, presents only two cooperative procurement models. The first one, the full cooperation model, is divided into a centralised lead buyer option, which is suitable for standard products, and a decentralised option which is suitable for more complex products, with all parties working closely together during all phases. The second model is identical to the Schotanus & Telgen (2007) hitchhiking model.

A Critical review on cooperative purchasing litterature

The broad definition (e.g. Schotanus and Telgen, 2007) counts as cooperative purchasing even when two organisations end up purchasing different products from different sources, if only some kind of information exchange, maybe just a phone call, takes place. Broad and differing definitions of what exactly is cooperative procurement do not help in building common theory and make comparing contributions more difficult. In their comprehensive literature review Glock and Hochrein (2011) identify 15 contributions from 1967 to 2009 in collaborative procurement, so the overall volume of research in this topic is rather limited. Of these, 12 are from the public sector which reflects its relative prevalence there. As why it is prevalent in the public sector, similar processes, the lack of competition and mutual trust are mentioned by Walker et al. (2007) while the legal restrictions of competition law in private sector appears unidentified in the literature. Glock and Hochrein (2011) identify the impact of public procurement on the structure of public purchasing as an unresearched topic, albeit from a literature survey that doesn't include any law journals.

In terms of research topics, both Schotanus and Telgen (2007) and Cagnazzo et al (2009) identify the following research themes in cooperative purchasing literature: advantages and disadvantages, enablers and preconditions, coordination structure, development over time and finally, formation of groups in electronic marketplaces. The theme of agency theory specifically in cooperative purchasing is discussed by McCue et al. (2015) and McCue and Prier (2008) and more generally in purchasing e.g. by Yukins (2010) Karjalainen et al. (2009) and Soudry (2007). For each theme, however, there is a limited number of contributions so there is little confirmative research.

There are rather few contributions in terms of what kind of products are suitable for purchasing cooperation. Walker et al. (2013) suggest that collaborative purchasing clearly benefits standard routine items where economies of scale can be achieved. Karjalainen (2009) writes that many nations have set up centralized purchasing units that purchase commodities. As to why commodities could be suitable for centralized purchasing, one reason is that there is no need for requirements specification, just choosing among commodities from frame

agreements. In terms of the Schotanus and Telgen (2007) model, centralized purchasing could be seen as bus ride-type of cooperation as it is close to a third party with low intensiveness and strategic importance. However, when this centralization is mandated by the principal, it is not cooperation in the sense of mutual benefit, at least, not necessarily.

Non-commodities, on the other hand, require specifications. In security organization, these can relate to the core mission of the organization. While end user satisfaction is important, it is not the only criterion that defines the best value. The soldier in the field, for example, is seldom satisfied with the equipment bought as "best value"—which points out a divergence of interests between stakeholders and principals (Yukins, 2010). The specifications determine the price and there is no easy way to enable end users to determine specifications because this may not result in the best value from the principal's point of view. McCue and Prier (2008) take an example where a cooperative is used to purchase police vehicles. During the vendor selection process, the purchasing agent in the cooperative may acquire information about a vendor who might satisfy the local preferences of some (or all) principals, but given the nature of the cooperative, the agent does not divulge this information to the cooperative principals. Thus, the principals may end up with an inferior vendor being selected by the cooperative.

INTERVIEWS AND A THEORY-BASED ANALYSIS OF THE CONTENT

In the study, we interviewed eighteen people who work in the field of public procurement. The interviewees are referred to as I1–I18. Five people work in the Finnish Defence Forces, four in the Finnish Police, six in the Finnish Fire and Rescue Services and three in the Finnish Border Guard. The interviewees represented the middle management or administration, and they had 2–20 years of experience in material projects. The names, positions or organisations of the interviewees are not presented in this article to protect the privacy and secrecy of the interviewees. This approach has encouraged a fruitfull discussion and openness.

The interviews were carried out as semi-structured thematic interviews where the interview themes were based on the literature. The interview themes were modified in two phases. During the first phase, we discussed the interview themes at a meeting, and we also proposed how they could be developed. At the second meeting, we ensured that the proposals had been fulfilled. We sent the interview themes to each interviewee in advance. The average duration of a single interview was one hour. Fifteen interviews were conducted in the facilities of the interviewees' organisation and three by using a videoconferencing system. All interviews were recorded and transcribed. We used text and theory-based content analysis as research method. The analysis and codes are based on the the different forms of Schotanus and Telgen (2007) model. The theory-based content analysis proceeded in three phases where the material was simplified, grouped, categorised and conceptualised. In the simplified phase we transcripted all the interviews. Notes representing cooperative procurement material, end user and forms of cooperative procurement were thus not created in advance but as the they emerged in the analysis of the transcripts. All notes were created during the analysis of the first eight interviews. By this time all the themes were emerged from interviews. In the last ten, coding was done using already existing nodes, meaning they only repeated and enriched current notes. This is a solid indication that theoretical saturation was achieved within the eighteen interviews (Eisenhardt, 1989)

Table 1. Operating costs per year in millions of Euros. Average of 2015 and 2016. Source: Netra, reporting service of the State Treasury and Fire and Rescue Services.

Expenses	Border Guard	Police	Defence Forces	Fire & Rescue
Material, supplies and items	14	33	250	22
Personnel expenses	167	570	881	228
Rent	20	69	186	45
Purchased services	28	114	687	42
Other expenses	8	18	376	3
Total	237	804	2,380	340

The expenses of the Finnish Defence Forces were roughly 2.4 billion EUR , those of the Finnish Police were one third of this amount, all the Fire and Rescue services comprise of one seventh of this sum and those of the Finnish Border Guard one tenth (Table 1). Personnel expenses accounted for about 70% of all the costs of the Finnish Border Guard, the Finnish Police and the Fire and Rescure services, whereas personnel expenses made up only 37% of all the costs of the Finnish Defence Forces., The Finnish Defence Forces has by far both the largest budget and the largest share of purchases compared to the other security organisations.

INTERVIEW RESULTS

The Finnish Defence Forces, the Finnish Police, the Finnish Border Guard and Finnish Fire and Rescue Services all use cooperative procurement as a procurement method. Every interviewee was able to name at least one public procurement process which involved at least two security organisations. On the basis of the interviews, the tasks performed by a single organisation or the cooperative procurement group include agreement negotiations, requirement specifications, commercial management, technical management, overall project management, exchange of information, testing, acceptance inspections, customer complaint processes and shared resources.

A cooperative procurement network has operated under the administration of internal affairs since 2014, and it has expanded to form the network of Finnish security authorities. Members of the cooperative procurement network hold annual meetings, at which they present their competitive bidding calendars. On the basis of these meetings, organisations that identify shared needs or are interested in future projects of other organisations start detailed preparations for cooperative procurement. Many interviewees stated that this cooperation is challenging because, in practice, the network is an expert body. It may not have any official or recognised position in cooperating organisations. For example, in more difficult cooperative procurement processes where one organisation is responsible for testing the procured material, there may be problems in leadership as commands cannot be issued across organisational boundaries. In the worst-case scenario, this leads to a situation where planned testing needs to be interrupted and a new project partner needs to be acquired. As a result, the procurement process slows down. During the interviews in early 2017, the interviewees representing the Finnish Border Guard and the Police of Finland revealed that the upper management did not fully understand and support the activities of the cooperative procurement network.

Material suitable for cooperative procurement

All the interviewees were able to name suitable items for cooperative procurements. The most commonly cited products for cooperative procurement were the so called commercial-off-the-shelf (COTS). This refers to materiel that does not need user-specific modifications, it

is the same for all users and does not need a requirements definition other than agreeing on the purchase criteria.
” When you buy materiel goods, i.e. COTS, which doesn't need tailoring”. I3“Bulk products such as Hansel can offer. Uniforms and all that stuff which meets your needs. When the product is clearly defined, and the need is very similar to each other. "(I17)

The second most commonly cited materiel suitable for cooperative procurement were items used by multiple authorities. It is natural for the security authorities to use similar, if not even the same, pieces of equipment. The Finnish Defence Forces, the Finnish Police and the Border Guard all use very similar protective equipment and firearms. Another example would be the Fire and Rescue Service, the military Fire and Rescue units and the Border Guard Fire and Rescue personnel as they all use similar fire-fighting equipment.
” All materiel that has more than one user. Weapons, equipment, vehicles etc.” (I1)
” All authorities that have dogs would probably benefit from tendering the purchase of dog collars cooperatively”. (I9)
“In the case of rescue vehicles, it would be possible for all the Finnish rescue vehicles to be procured through the same project and the same deal could then be used by other security operators as well”. (I16)

One interview mentioned that a cooperative procurement could also be a platform, such as a vessel where different authorities may install their own systems.
”Such projects that have space and opportunities for various kinds of missions. Boats and ships are then platforms that we can mount different equipment on. (I7)

Material unsuitable for cooperative procurement

According to the interviewees, there are only few types of procurement projects that are unsuitable for cooperative procurement between security and rescue organisations. Six interviewees could not name any unsuitable projects. The most common reason for not procuring something cooperatively was materiel related to each organisation's unique activities, where the other organisations were seen as not having the need for procuring this equipment.
” Procurements are meeting our own functional requirements. Those that are a part of our own powers or jurisdiction”. (I3)
"Customized Products. For example, the command and control vehicle for the Fire and Rescue Service. Helsinki had quite different requirements from Vantaa. One reason was the tram lines that set their own demands on the vehicle. "(I13)

In two interviews, other reasons for not doing cooperative procurement surfaced. One interviewee saw that when the goal of the project is top performance, other organisations are not wanted because in that case compromises will have to be made on the performance or capability of the project. The same interviewee also said that when procuring is an urgently required capability, a cooperative procurement is not wanted because it causes delays. Only in one interview it was suggested that the organisation should guard rigorously its capabilities and procurements, and therefore avoid any collaborations with other organisations in procurement projects, in order to prevent future compromises.
” Niches and things related to your own special activities. Where compromises endanger your own needs. Or then a capability that is temporally limited or narrow in terms of the scope of the capability but extremely finely tuned. If one wants top capability, then you don’t want any distractors.” (I7)

"*Probably certain pieces of kit for Special Operations Forces. That are classified anyway. Protecting your capability is one of the most important ways to keep your procurements away from the limelight. If it's done as cooperative procurement, there are risks"*. (I9)
"We do not want compromises, only the best possible product or service."(I18)

End user in purchasing project

In all interviews it was stated the importance of the end user in a purchasing project. End users were mainly involved in the process by outlining the technical requirements. This is a logical solution because in the end purchased products and services are used by the end user. If this basic need is not fulfilled it might lead to a situations where organisations or individuals not using the product. In two interviews, it was reported that one security organisation didn't continue the cooperative procurement process because their needs were in danger of not being fulfilled. In one interview, it was stated that fire and rescue organisations made a contract about the fire helmet without an end user opinion regarding the technical specifications. The outcome was that the Fire and Rescue department did not purchase those helmets because there end user needs were not fulfilled.
"We just finished our long cooperative procurement project, a lightweight bulletproof vest. However, the police forces exited from project, cause their end users did not accepted the compromises in technical issues." (I9)
"The firefighter helmet project was carried out in the north. In the end nobody bought the helmet. Not a single Fire and Rescue Service. There were not end user requirements in the project, they used only some standards and that was the root reason why helmet acquisition failed." (I13)
*"The disadvantage of cooperative procurement may be the non-fulfilment or abandonment of own specific needs. Compromise can mean not satisfyingthe user requirements and this can put reputation at risk." (*I2)

In some cases even differenent end users may have different requirements from the same product. The reason can be the usage of the product in different environments or the multiple ways of using same product. The end user was conceptualized in two ways. The majority of the interviewees saw that the officer who works in the field is the end user. But in one interview the security organisation can also be the end user. In this case the end user was defined as the owner of the technical understanding of the product.
"If we speak about firefighter suits, we use them more than any other Fire and Rescue Service. That's why we emphasize user requirements related to maintenance and washing. For example, can we use industrial washing, how the suits can be repaired? I18)
"The helmet for the motorcycle and snowmobile drivers was a good cooperative project because it was suitable for the police and the border guard, and so the volume of helmets was increased. At the beginning of the project, users were having different views on what they needed from the helmet. Views were different in the Northern part of the country and coastal areas. "(I8)
"We had cooperative procurement of bulletproof vests for the Border Guard, the Police and the Customs. This kind of product may have technical requirements that the Hansel can not understand. The Hansel can handle simple cases, but not special cases. Because then the technical understanding should come outside the Hansel and whether it makes sense to spin it through." (I8)

Forms of cooperative procurement

All interviewees identified hitchhiking as a possible form of cooperative procurement in their organisations. They did not regard hitchhiking as a poor alternative, but as an opportunity to carry out cooperative procurement processes. In particular, the interviewees considered that simple material, i.e. off-the-shelf material, is highly suitable for hitchhiking. While hitchhiking is possible with different volumes, its alternative is that two or more organisations maintain a long-term arrangement. This means, for example, that whenever specific material is procured, the same hitchhikers are involved in the process. In general, hitchhiking requires two organisations. In some cases, the organisation that holds the primary responsibility can carry several hitchhikers.

"When someone has already done the acquisition, is there a point of doing the same job again? Better is to save the resources and take the fruits. We just inform them what is our quantity and pay the fee if its needed."(I16)

"Recently, we have started to use more Hansel. We want to take full advantage of its framework agreements." (I18)

Four interviewees pointed out that, even if an organisation is only involved in indicating the volume they need, the participating organisation must pay for their share of project costs. In some cases, the costs can be divided based on the required volumes or evenly across participants. The bus service model has one organisation that bears the primary responsibility, and there can be any number of organisations participating with any specific volume.

"Usually, we require that participants must have some input. Especially if we use external consultation, such as commercial experts or legal counsels, these costs are divided between all participating organisations, evenly above all else, regardless of volumes. We have also made compromises so that we have covered the largest proportion of these costs." (I2)

The security organisations, where the interviewees work, specialise in different official duties. The Finnish Defence Forces is in charge of external security, and it specialises, for example, in material projects for military defence. The Finnish Police is in charge of internal security, and it requires equipment for criminal investigations, speed limit enforcement and driving condition enforcement. The Finnish Border Guard aims to safeguard Finnish borders, and it requires equipment related to the fulfilment of this mission. In addition, cooperative procurement processes are divided between these security organisations in accordance with the aforementioned missions. However, carpooling allows the participating organisations to share their expert resources. For example, the procurement unit may obtain experts from another organisation for testing or specification requirements, while the procurement unit is responsible for the overall procurement and its results. In some cases, it is possible that requirements are defined together, after which each organisation carries out their own procurement process (Schotanus & Telgen, 2005).

"Procurement processes often demand substance-based requirements that are defined by the organisations who have the necessary experts. For example, we carry out the bidding process, because we have that kind of expertise. Then again, if the aim is to acquire something completely different, it's also possible that we act as the receiving party." (I3)

"In fact, we carried out a bidding process for the procurement of protective vests for the Border Guard and Customs." (I8)

Two interviewees mentioned a material project in which several different organisations were involved in the requirements specification and bidding processes. One of these interviewees pointed out the interest of an external organisation in the project, as its involvement would have significantly increased the total procurement volume. The other interviewee stated that, even though a few organisations had made the preparations required for the material project,

they would have allowed other security organisations to join the process. On the basis of these interviews, a convoy is not a pre-planned operating model, but rather an exploitation of opportunities that open up along the way. Neither of the two interviewees recognised the convoy model as an existing or planned option. According to these the interviews, the involvement of new organisations in a convoy by volume only is related to personal relationships and the resulting exchange of information.

"We had a Nordic ammunitions project, in which we carried out the requirements specification and testing processes together with the police of Sweden, Norway and Denmark. Norway was responsible for commercial preparations and the bidding process, while we were in charge of requirements specification, product testing and scoring. When the project was about to close, the National Gendarmerie of France was interested to take part in the project with their volume. This would have multiplied the number of ammunitions by five. However, their involvement wasn't possible due to the French procurement legislation which prevents cooperative procurement with other countries." (I1)

"We prepared specifications for protective vests together, and launched a bidding process for several security organisations. We could have included the police in the offer." (I8)

All interviewees recognised the existence of an F1 team in cooperative procurement. The interviews revealed that the most common way is that a project is divided into commercial and technical parts. The primarily responsible organisation is in charge of both parts. Project teams include representatives of all organisations. One interviewee mentioned an example in which the commercial part was outsourced to an external organisation.

"We can distribute tasks between different parties. For example, a single party can define the specifications for the procurement. (I7)

"It's important to set technical and/or performance requirements. However, considering cooperative procurement, it's equally important that a specific party coordinates the requirements prepared by different organisations and fits them. It's challenging to prepare shared requirements." (I8)

"We bought the commercial part and the agreed consulting services from Hansel, but otherwise we prepared the specifications and tested the products together with the Border Guard." (I3)

Two interviewees mentioned a form of cooperative procurement that Schotanus & Telgen (2007) have not identified. In this form, at least one organisation takes part in the requirements specification without covering any costs. The requirements specification may concern the entire procurement or an independent system which is part of the whole process. A ship offers an example where the ship is the object of procurement in which several different systems can be installed. In this case an external organisation or the external organisations do not cover the costs arising from their requirements. This operating model requires support and control from the management of both organisations in order to succeed. This operating model can be applied to nationally significant projects.

"I'd like to mention a special case in which an external organisation defines the specifications and sets the requirements for procurement without covering any costs. Costs are covered by granting higher appropriations to the procurement unit. Another example is a case in which the performance level of a project is increased by acquiring oil spill equipment, monitoring equipment or anything else." (I1)

"It's possible that we acquire the equipment which is then installed on a platform. It's also possible that one organisation defines the specifications, and another one acquires the equipment." (I7)

Table 2. Inteview (n = 18) themes and their interaction with organization form.

Themes relating participation	Themes relating to procurement items
• Volume benefits (Hitchhiking 18 and Bus ride 18). • Fee (Bus ride 18). • Providing resources (Carpooling 18, Convoy 18 and F1 18). • Divided purchasing project (F1 18). • Outsourcing some parts of project (F1 5). • Technical requirements, no compensation (Politically mandated F1 team 2) • End user participation (Carpooling 18, Convoy 18 and F1 18)	• Commodities / COTS (Hitchhiking 18, Bus Ride 18). • Non-commodities (Carpooling 18, Convoy 7, F1 7). • Top performance (Carpooling 3, Convoy 3, F1 3). • Functional requirements (Carpooling 7, Convoy 7, F1 7)

The interaction of the interview themes relating to item and participation, like paying a fee or providing resources with orgnaisation form is shown in table 2 where the number indicates in how many interviews this theme was mentioned in connection to each organisation form.

DISCUSSIONS OF THE RESULTS

In general, all interviewed persons had a positive attitude towards the purchasing cooperation between security and rescue organisations. One interviewee added a concern that the cooperation needs to be mutual. According to the participants the main purpose of procurement in security and rescue organisations is to fulfill the needs of the end user. However, some of the purchased items are commodities, where the end user's opinion and needs are not crucial for carrying out purchasing. In this category of material and services, security organizations don't have special needs. Such materials can be procured centrally through Hansel Oy, the Government procurement organisation.

The somewhat self-evident fact that procurement collaboration is possible only when the purchasing need is not unique but shared with some other security organisation also came up in the interviews. But with some kind of purchases, security and rescue organizations do have special needs. In these cases collaborative procurement projects could be arranged among security organizations with end user involvement in defining the requirements. When the need of the end user is not fulfilled and it is possible that the end user chooses maverick buying in order to fulfill the required needs. If the principal fails to identify the agent special need it might lead to purchasing material which agents don't use. The interviews pointed out two examples of how the principal-agent roles and their different goals can have an effect on cooperative purchasing projects. The uniqueness of the need arises from the performance requirements of the equipment that is spefic to that organisation. However, there was also a statement on maintaining secrecy and avoiding cooperation with other organizations with respect to Special Operation Forces equipment.

According to the model of Schotanus & Telgen (2007), there are five different forms of cooperative procurement. On the basis of these interviews, we were able to confirm the existence of these forms in cooperative procurement processes between the Finnish security organisations, with the exception of convoy. None of interviewees had any experience with the convoy model in cooperative procurement processes. However, it was recognised as a possible form of collaborative procurement, albeit a one not used in practice. A possible reason why convoy is so little used could be that Finland has only few security organisations

and people, who are involded in purchasing, know people in other organisations. When organisations start a cooperative purchasing project they involve all possible organisations from the beginning because of the existing network. So there is no need for any security organisation to later join a project. But Convoy could be a useful form of cooperative purchasing in projects which are multinational, as mentiond in one interview. On the other hand, it was also possible to identify a new form of cooperative procurement based on two interviews, a politically mandated F1-team. As such, it is a fairly rare form of cooperative procurement. In this novel procurement form there may be collaborating organisations giving their own requirements for the project without covering the costs that these requirements cause to the organisation that is purchasing the equipment. Instead, they are covered by other participating organisations. In practice, such a form can exist only in the public sector where it can be understood through the levels of public administration as presented by Mccue and Prier (2008). Such a form makes sense only from the perspective of the overall principal, the Government, for whom it may be the most affordable operating method where a particular agent ends up paying the costs of minor relevance. Such a model is applicable only for major purchases that reach the Government level. We found that the forms of hitchhiking and bus ride are is associated with commodity-type items as shown in table 2 which is not explicitly discussed by Schotanus and Telgen (2007). In a few interviews we also found evidence that the agent and the principal roles and their level of participation might depend on the chosen form of cooperation.

Schotanus & Telgen (2007) identify free-riding as a disadvantage of cooperative procurement. None of the interviewees, with the exception of one, did recognise this disadvantage. Free-riding was identified, but it was not regarded as a problem if each organisation allows other organisations to take a free ride in turn. On the basis of these interviews, we can state that, if organisations, who take part in cooperative procurement, have mutual trust achieved through years of cooperation and it is apparent that their partnership will continue in the future, free-riding is not a problem in cooperative procurement processes. The interviewees stated that standard equipment is an advantage of cooperative procurement, as it produces savings in the areas of maintenance, training and operations. Schotanus & Telgen (2007) perceive harmonisation only as a disadvantage. This conflict between the interviews and the literature could be easily explained since harmonisation is considered to lead to compromises over performance requirements, whereas the interviewees stated that products used by security organisations are often so similar that cooperative procurement processes do not put performance at risk. One interviewee pointed out that cooperative procurement does not always produce savings in procurement resources; instead, the need for resources increases. Schotanus & Telgen (2007) also make this observation. Nevertheless, cooperative procurement processes do not only produce benefits for individual organisations. In particular, when looking at such processes from the perspective of taxpayers and the public administration, the increased workload of individual organisations can produce overall savings and improve the efficiency of resources.

CONCLUSIONS

Security and fire rescue organisations provide standard public goods for which markets do not provide the optimal level of welfare. Because the principal's ultimate goal is to minimise the need for such organisations (e.g. prevention of crime), output-based (e.g. number of indictments) contracts would align interests less than perfectly. Outcome-based contracts that mitigate the agency problem, as recommended by Eisenhard (1989), are not as simple to implement in purchasing because minimising purchasing costs does not take into account the

end-user value. In public purchasing, behaviour-based contracts appear to be the only viable possibility, as their objective is to maximize the cost-effectiveness, through the reduction of the total cost, while raising the hard-to-measure end user satisfaction, unlike in e.g. sales where the incentives of principal and agent are easy to align. When behaviour-based contracts are used, the principal tries to minimize the agency problem through rules-based control, accountability, oversight and bonding (i.e. punishments) that comes in the expense of efficiency. Soundry (2007) writes that a fairly stringent rule-based approach deprives procurement agents of the amount of flexibility needed in order to achieve the best economic results; especially in cases where contracts are more complex.

The cooperative purchasing forms of Schotanus and Telgen helped to identify different forms of cooperation. This study can confirm tis model within the specific context of security organisations and at the same time identify a novel form of cooperative purchasing, the politically mandated F1-team. However, the operationalisation of the dimensions of intensiveness and number of activities and, therefore, the identification of the most suitable form, needs some judgement as there are no clear-cut criteria for the dimensions. In this study, the low intensive cooperation forms where those with the commodity-type items purchased through a centralised unit (Hansel Oy) that, at the same time, is serving also all other government organisations, while the more intensive forms (lead bying, and both F1-teams) were the subject of cooperation between security and rescue organisations.

Cooperative procurement in public sector can be examined from the perspective of individual purchasing organisations or the entire public administration, highlighting the existence of multiple agency levels identified by McCue and Prier (2008). This became apparent both in the case of centralized purchasing conducted by Hansel, from where the Government mandated commodity-type items to be purchased by security organisations and in the case of larger purchases where some organisations could participate by setting their requirements. This and other instances show that agency theory can provide, as Yukins (2010) claims, “a versatile prism” view of issues associated with cooperative public purchasing. However, cooperation is not a principal-agent relationship and important themes like mutual trust needs to be complemented with other “prisms”.

Overall, the experience of cooperation was positive and from the Governent’s principal point of view; it is a recommendation for Finland’s public purchasing strategy. Then why it is not more common? One reason is the lack of common equipment needs while this could be also a topic for future research. Cooperative procurement between security organisations dealing with specialized equipment would benefit from the support of the upper management. The cooperative procurement network of security authorities has not received this type of support, as its activities were limited to the collaboration among experts.

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Barriers to Strategic Supply Management
– a top management perspective

Abstract

In the general management literature flaws and distortions of managerial decision making have been devoted increasing interest during the latest decennia. This paper elaborates theories on managerial cognition within SM context. During two-three decennia the strategic orientation of SM has increased, but top management insight of the strategic SM in firms has grown slower than expected. This paper suggests explanations for this slow top management adaptation to the grown importance of external resources and SSM. We have integrated frameworks from cognitive psychology with empirical findings from top management teams of three case companies and five SM-related change projects within them.

Keywords: strategic supply management, framing, case study

Introduction and motivation

Rationality is an attribute connected to the purchasing and, more generally, operational management literature (Barratt, Choi, & Li 2011). The drivers and rationale of new and more strategic approaches to SM have been described well in the literature since the 1980s (e.g. Kraljic 1983; Leenders et al 1988; Cox et Lamming 1997; Trent 2007; Tanskanen et al 2012; Laiho 2015). Much of the related research is limited to rational benefits, operationally optimal solutions, and best practices; however, implementation and human resource issues have received less attention (Fawcett, Magnan & McCarter 2008; McCarter, Fawcett & Magnan 2005). Barriers and behavioural hindrances to SSM seem to be especially weakly covered (Moberg, Speh & Freese 2003) and the more recent literature does not seem to fully cover this gap.

Fawcett et al. (2008) addressed barriers to successful SC collaboration, an important dimension of SSM. They suggest that the primary barrier to collaboration is human behavior in different forms: "organizational culture and structure, functional conflicts, lack of managerial commitment, conflicting and non-transparent processes, policies, and procedures, performance measurement, information sharing, lack of trust, resource constraints, and complexity of SC networks". All the issues are inherently such that top management will be involved, with their activities impacting on the issues.

Koen Vandenbempt and Paul Matthyssens (2005) studied barriers to strategic innovations and suggested that the barriers have both cognitive and structural dimensions. The cognitive dimension relates to the mental models of individual executives, based on perceived outdated cause-and-effect relationships. With time the cognitive barriers have become embedded in the structures, routines, and cultures of firms (Vandenbempt & Matthyssens 2005). Their paper offers relevant views to our phenomenon of interest, because a change from operational PSM to strategic SM can be seen as a company's internal strategic innovation, suggesting changes in resource allocation, organisation, and processes.

This paper is focused on barriers to top management cognition of strategic opportunities through effective utilization and management of external resources; that is, SSM. The following question addresses both the individual level and top management team level:

What are the potential barriers and hindering mechanisms to top management cognition of the strategic importance and opportunities of supply management and external resources?

Theoretical foundation

To understand the real reasons for some issues being recognised as important and worthy of action, or why decisions are made or not made, requires the evaluation of individual decision makers' complex mental processes. This paper is build on two basic concepts, namely that of bounded rationality by Herbert Simon (1997(1945)), and contextual framing and anchoring put forward by Gregory Bateson (2000(1972)), Amos Tversky and Daniel Kahneman (1981). Based on further managerial cognition literature, we also develop a model of an issue's rise to top management's attention.

Bounded rationality

Herbert Simon suggested that traditional economic theories contain a hidden expectation of an "economic man" who makes rational decisions and has unlimited wisdom and capabilities (Simon 2010, p. 99). Simon's conclusion was that an executive can never be fully "rational" in decision making as, in a complex world, he/she can never know everything that influences the premises of the decision. He described the individual weaknesses of decision making as bounded rationality: "the pattern of human choice is often more nearly a stimulus-response pattern than a choice among alternatives. Human rationality operates, then, within the limits of the psychological environment." (Simon 1997, p. 117).

Framing and anchoring

Gregory Bateson (1972) developed a concept of psychological framing, proposing that a frame (around an issue) means that different thinking should be applied to an issue within a frame than outside it. He suggested that any message that defines a frame (explicitly or implicitly) also factually gives the receiver instructions as to how to interpret and understand this message. This frame is anchored in cognitive frameworks that guide interpretations (Bateson 2000). The concept of framing has been further developed and applied within psychology (e.g. Minsky 1975) economics (e.g. Tversky & Kahnemann 1981), sociology (e.g. Young 2010), strategic change (Kaplan 2008) and also supply management (Tokar, Aloysius, Waller, & Hawkins 2016). Referring to Tversky et al, Bendoly et al. (2010) argue that a key source of flaws in operational decisions is inappropriate framing through inadequate adaptation to the situational context.

Factors raising an issue to management's attention

In the complex and continuously evolving business environment, members of top management can be regarded as information workes, spending their time in absorbing, processing, formulating, and deploying information on issues, problems, and opportunities (Walsh 1995). They cannot scan every aspect of an organisation or its environment. An executive's perceptions are limited as a result of his/her selective perception of only some of the visible phenomena. Further, the information selected for processing is interpreted through a filter of cognitive bias and values (Hambrick et al. 1984; McKenney et al. 1974).

Raw signals from the environment are not devoted attention, until executives interpret their causal relationship with the firm's activities. Attention focus is linked to an executive's causal logics (mental models, personal constructs) describing his/her understanding of how the world works; that is, the causal relationships between different phenomena in the business

environment. Together, attention focus and causal logic filter and shape the responses of individual executives and management teams to environmental changes (Nadkarni et al. 2008).

Nadkarni et al. (2008, p. 1399) propose that individual executives focus their attention on environmental changes that seem to be potentially important for the performance of their areas of responsibility and ignore environmental signals concerning changes and phenomena perceived as 1) less relevant for themselves, 2) usual or 3) expected. (These views are integrated into a model which is presented with empirical findings in *Picture 3.)*

Dominant logic and the management team's agenda

Joint discussions and interpretations develop joint beliefs in relationships between environmental events and a company's strategic concepts. In the long term, this common causal logic is argued to be the primary basis for decision making (Nadkarni et al. 2008). Prahalad and Bettis employ the term "dominant management logic" (Prahalad et al. 1986) to describe "a shared understanding of the factors relevant to the business's strategy and the relationship between these factors" (Bettis et al. 1995).

Kamann et al. use contagion as a term describing the process of the homogenisation of views and mental models, i.e. the development and strengthening of dominant logics within a team or organisation, but also within industry networks (Kamann et al. 2004). Within a network the socially leading actor or group of actors set the network's way of doing things, the socially negotiated network order. The evolution of dominant logics happens in two ways: both through the selection of actors who appear desirable (showing desirable attributes) to the network and through contagion (conditioning) to discourage deviating behavior (Kamann et al 2004).

Research methodology

Through studying individual perceptions, we will be able to create a broad understanding of the factors driving firm-level behavior related to SSM, including individual perceptions and common dominant logics. In this study, we have focused on the cognitive framing of top management team members who make or influence SSM-related decisions.

Ontology and epistemology

We adopt constructionist epistemology as the philosophical basis for this research. A constructionist perspective rests on the assumption that human beings impose their internal perceptions on the external world and, in so doing, actively create their individual realities based on their individual experience (Kelly 1963). This philosophy has also been termed constructive alternativism, which "is the idea that, while there is only one true reality, reality is always experienced from one or another perspective, or alternative construction. I have a construction, you have one, … even someone who is seriously mentally ill has one. Yet no-one's construction is ever complete -- the world is just too complicated, too big, for anyone to have the perfect perspective" (Boeree 1997).

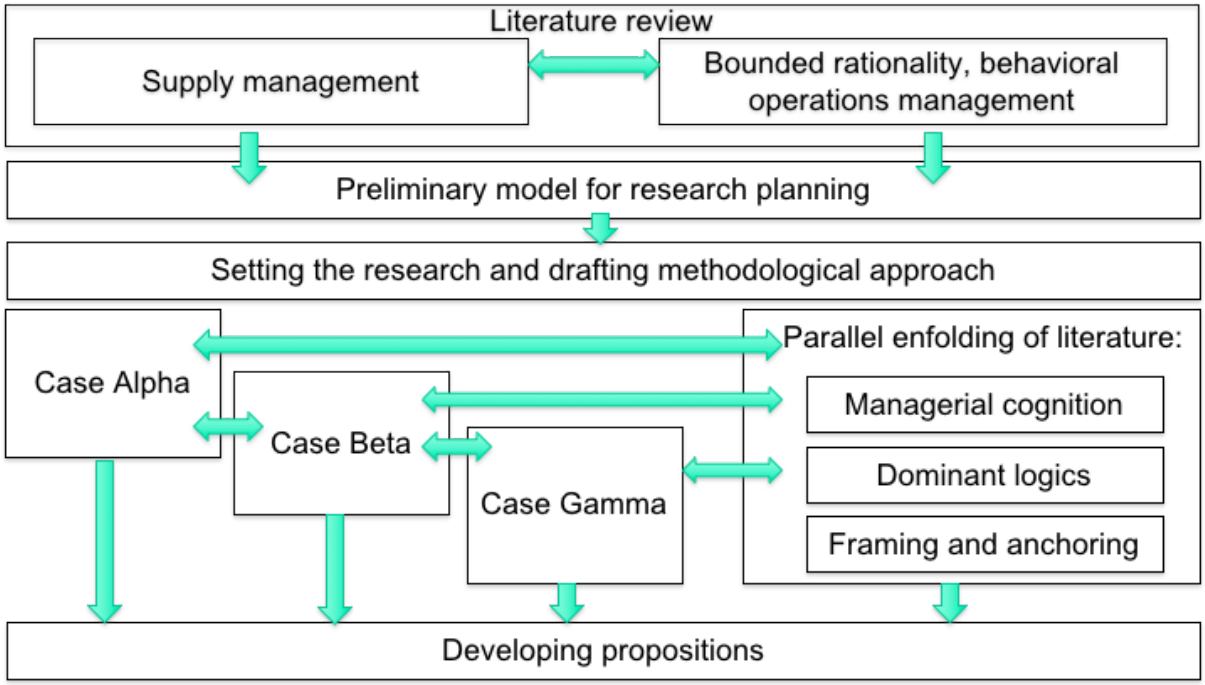


Figure 1. An overview of the research process

Selection of the cases

A preliminary study on perceived strategicity of purchasing (Aminoff et al. 2008) was based on interviews with selected top-level supply executives in large industrial companies. In one of these companies the apparent conflict between the high relative share of the purchased spend and the perceived purely operational role of PSM seemed to be obvious. The phenomenon of interest should thus be clearly visible within that organisation, which would be an optimal selection as the first case (Alpha).

The second case was purposefully sourced utilising a clear criterion: to enable reasonable cross-case comparability, it should be contextually similar to the previous case company in as many dimensions as possible: an industrial company, operating internationally and facing international competition. Preferrably, it should operate in a different industry to avoid potential hidden implications of industry features. To give richer insights into the mechanisms of missing top management cognition, an optimal company would not have invested anything in PSM training or development. A nearby optimal company, a mid-sized high-technology company (Beta), was identified and contacted.

To explore deeper the mechanisms influencing top management cognition of PSM, we endeavoured to identify a company in which a recent radical change in the top management's attitudes had occurred, witnessing a visible recognition of SM. Gamma was selected purposefully to shed light on the process, what happens before and after top management's nascent cognition of the importance of SSM.

These three companies represent different industries. Alpha and Beta represent two very different high-technology industries, both focusing on high-quality branded goods in global markets, also being market leaders in their national markets. Gamma represents a more slow-moving industry with relatively simple technologies. All the three companies were high performers, both in the short and long term, with highly appreciated management. Each case company enjoyed a leading position in its respective national market within its industry/main

business. Each case company had an international frame of performance. Each of them also had experiece of direct sourcing activities in LCC's. Each case company faced global competition, both locally and internationally.

Alpha and Beta represent highly R&D- and marketing-focused businesses. Especially in Alpha, product development projects were expensive and lengthy, handled as long-term investments by management. Margins were high because of successful R&D; however, so too were the risks relating to R&D projects' long time spans. In Beta, the key drivers of success were technological leadership and a top-quality product brand. In both Alpha and Beta, purchased cost or supply market analysis played a minimal role in the R&D process. Once a supplier was selected to deliver a component or service for a product, they were seldom changed over the product's lifecycle. Purchasing was more an internal service function, a supplement to production. The top management's focus in both companies was heavily on R&D issues and global marketing. In Gamma, the management's focus was on the economic performance of local BUs that were running similar businesses across the country. R&D and marketing played minor roles, although intimate sales and customer service were important success factors. The role of purchasing had changed radically towards SSM as a result of its newly-born recognition by top management.

In all of the case companies, earlier SM-related change initiatives was identified. The first initiative in Alpha (Alpha 1) had occurred five years previously. It had been limited to the centralisation of fragmented purchasing functions, new resources, and professional training as an internal exercise within the purchasing organisation. Two years before this research another development intiative (Alpha 2) covered all the purchasing and SCM organisation, focusing on total cost thinking. Although the project had noteworthy economic results, the consequences and cognition remained functional. In Beta, the exercise (Beta1) had focused on a new plant streamlining production and supply chain, but did not question existing supplier relations nor lead to top management cognition of SSM. In Gamma the first cross-organisational training exercise (Gamma 1), had occurred five years earlier, had led to significant economic results but did not lead to top management cognition of SSM. Another hands on training project on SM (Gamma 2) was organised six months before this study's interviews. During this process, visible CEO cognition of SSM had occurred, leading to e.g. immediate CPO nomination, demanding targets on SM and weekly discussions in the top management team (TMT).

Data collection

The primary scope were the top management teams of industrial companies. We interviewed 28 top management team members and two purchasing managers (PM's), as well as 6 mid level executives in Gamma to hear non TMT viewpoints on the change:

1) Alpha: previous CEO, CEO, 9 TMT members, PM
2) Beta: CEO, 8 TMT members, PM
3) Gamma: 2 previous CEO's, CEO, 5 TMT members (incl CPO), 6 mid-level executives.

Numerical data and deeper understanding were gathered through repeated discussions with the Purchasing Manager (Alpha), PM and VP SCM (Beta) and newly nominated CPO (Gamma). The findings were tested through their presentation at top management team meetings and discussions with CEO's. The interviews were tape-recorded, and transcribed by a research assistant. In Alpha the interview notes were handwritten by two participating senior researchers, the notes integrated and possible corrections asked from the interviewees within two days.

The interview questions

The key interview question was an open bid to elicit a description of the evolution of SM in the company as perceived by the interviewee. This should enable the full richness of the real perceptions to be best heard in the stories. The interviewer endeavoured to avoid any indication of preliminary propositions and did not address them during the interviews to avoid causing biases, distortion, or framing in the answers.

Complementary questions on drivers for and barriers to SSM were employed as necessary to cover all the issues wished: perceptions of SM's strategic potential and its relative importance and also evolutionary perspectives on the future were asked in varying order, depending on the flow of discussion.

The last set of questions was designed to gain the interviewees' insights into and practical knowledge of the tools and methods of SSM and to evaluate their preparedness to identify alternative differentiation opportunities and participate in related decisions.

The analysis process

In analyzing the interview records we utilized the causal mapping techniques as presented, for example, by Miles and Huberman (1994). Causal mapping is a generic technique for describing interdependencies between issues and/or events. As a general tool, it is appropriate for structuring messy and complex data and for managing large amounts of qualitative data (Ackermann et al. 1992). It can be employed to integrate individual perceptions of a situation into an evolving overall mental map of the researcher (Miles & Huberman 1994, p. 152).

Figure 2: An example of causal mapping of an individual interview in Gamma. The interviewee spontaneously separated the issues related to first (left) and second development project (right), as well as their backgrounds and reasons for outcomes and consequences. (The numbers are only for coding purposes.)

Causal mapping was in the first phase employed to describe the reasoning of the interviewees for perceived causal relationships concerning SM; that is, their perceptions of what is caused by which issue, activity, perception, or phenomenon. Through causal mapping technique, we captured the individual reasoning of the insights through drawing causal maps for each interview, one of which is shown below (just to visualize the idea), as well as summarized the dominant logics of each management team and the reasons and consequences of development projects. In addition to causal map-based issue identification and categorization, the chapter-, sentence-, and even word-level coding of the interviews was also used.

Abductive reasoning

Finally, we conducted trials to dig deeper and search for potential underlying root causes of the most important cross-case patterns. For this, we employed abductive reasoning (Douven 2011). The idea of abductive reasoning is to find the most probable explanation for a set of observations. It is reasoning from effects (findings) to causes or explanations (Lamma, Mello, Milano and Riguzzi 1999). The explanation should be sufficient, but not necessary cause of the observations. This thinking was first introduced by Charles Sanders Peirce (1839-1914) with the term "guessing" and it has been regarded as "a deliberate and creative part" of the abduction process (Tschaepe 2014). Abductive reasoning applies earlier theoretical knowledge, e.g. frameworks from other disciplines, to explain the empirical observations, to "match" the observations with appropriate frameworks (Spens & Kovács 2006). The process is thus one of continuous iteration between the observations and potential theoretical frameworks, constituting a learning process (Dubois & Gadde 2002).

Findings

Through the interviews, participant observation and other data, a good visibility of five development initiatives involving SSM was gained in the three companies, each more or less successful. Of these five development projects, only one, Gamma 2, had led to immediate behavioral changes at the top management team level. Three projects were purely functional, Alpha 1 and Alpha 2 being internal to purchasing and Beta 1 extremely production flow-oriented, and one project (Gamma 1) just did not awaken management's broader recognition after the project, despite cross-functionality, management participation, and convincing results.

Within all the case companies, the expected phenomenon was clearly visible: the share of the external spend was high, exceeding 70% of the cost structure, but supply-related issues were on the top management team's agenda only as operational issues, either as routine reporting of operational figures or relating to some sort of problem. The perceived content of the purchased spend was limited to direct, production-related purchases and neither its relative importance nor differentiation opportunities were recognized. The strategicity of SM was not visible on management teams' agendas, strategy processes nor organizational role.

Perceived strategicity

SM was not perceived as strategic by the CEO's or TMT's. "Supply management is not so important for us, because we are a high-quality technology leader in R&D-driven business" (VP, Beta). SM-related issues arose in the company's strategy process only through the production-focused SCM organization's operational strategy process flow (i.e. Alpha and Beta) or hidden in operational plans and budgets (i.e. in Gamma before the change). In Alpha, SM-related issues were perceived as being on the top management team's agenda irregularly, "only

when there is a problem". Supply- related issues were presented to the management team by VP Supply Chain (SC), focus being on quality and logistical efficiency, capital employed and availability. In Beta, VP SCM presented purchasing and supply management related issues, if needed, when something "special" occurred; for example, "supplier delivery or quality problems". In Gamma, SM-related issues before the change were perceived as being local business issues and were seldom discussed by the management team. "The management did not have any idea of supply management's potential as a source of competitive advantage, the methods of effective supply management, nor the efforts needed" (CEO A, Gamma).

Perceived economic importance

The management team members in Alpha and Beta did not know the relative share of the externally purchased spend, but underestimated it, most about to the level of the direct spend, the external part of the Bill of Material (BOM). Because the indirect spend in all the companies was remarkable, the estimated relative share was roughly at the level of half of the real share.

Perceived opportunities for differentiation

McKenney et al (1974) suggest, that consistent modes of thought develop through training and experience. For the purposes of this research, we have selected knowledge of the methods of modern SSM as a proxy for the identification of strategic opportunities through them. We expect that opportunities to differentiate oneself from one's competitors depend on the capability to understand different methods of SSM. If a broad set of methods are understood, then the opportunities achievable through them can also be identified.

Only one interviewee, the CPO in Gamma, had a university education in modern SM. No other interviewee had undergone SM-related school or university education. Only one interviewee (in Alpha) had been working in a firm with developed SSM. Most of the interviewees in Alpha and Beta somehow confessed their weak personal knowledge of the methods that PSM has to improve the company's performance. Their answers to questions concerning methods varied widely, which can be interpreted as meaning that there have been no common discussions of these issues. Nobody in Alpha or Beta mentioned e.g. the (strategic) segmentation of the purchased spend or total cost thinking, which can be regarded as the two basic frameworks of SSM. On the other hand, the interview records indicated that Gamma's management had well understood tools and means of modern SSM. Within the second initiative in Gamma all the top and middle management had participated in an intensive training and hands-on learning exercise, developing and implementing category strategies in cross-organizational teams.

Proposition 1: An individual executive's limited education and experience path, without exposure to the strategic utilization of external resources, are barriers to cognition of the strategic potential of SM and external resources.

Production-focused reporting on external spend

The total use of the externally purchased spend was not reported as an entity, but in all the cases fragmented under different cost headings in the profit and loss statement. In Alpha and Beta, the total sum and content of the indirect spend in a broad sense had never been calculated. A Bill of Material contained externally purchased materials, components, and services, but they are seen and evaluated from the production point of view. Only the production-related direct spend was visible in top management reports as purchases. This makes it understandable that the management team members clearly underestimated the size of purchased spend and never recognized the relative share of total external spend. Management reporting can be regarded as

playing a role in limiting or enabling understanding of both the content and relative importance of the external spend.

Proposition 2: Fragmented and production-oriented management reporting of the external resource spend creates a barrier to recognizing the economic importance of SM and external resources

Inward-oriented dominant logics

There were prevalent strong dominant logics within the management teams of each case company. In Alpha, the dominant logic emphasized the importance of long-term R&D projects and regarded production costs and PSM as less important. In Beta, the dominant logics emphasized high-quality branded products, for which PSM might even cause quality risks. In Gamma, the dominant logics emphasized full independence of Business Units, which is in conflict with SSM's ideas on coordination. The strategic supplier selections and decisions were actually made by either R&D or local BU's, without adequate education or experience on modern SM. Suppliers or external resources were only exceptionally discussed in management teams ("only when problems").

Proposition 3: Inward-oriented dominant logics of top management teams create a barrier to recognizing the strategic potential of SM and external resources.

Transactional framing through terminology, operational role

Although the interviewer systematically formulated questions using broader terms (procurement, supply management), the terminology employed by the interviewees was traditional and transactional (buying, purchasing). This seems to reflect the general vocabulary regarding these issues: broader terms were relatively new, and not broadly established in the common company languages. The transactional terms used seem to indicate that purchasing is perceived as having only a marginal influence on prices (e.g. Alpha: "routine discounts", "bargaining", "routine negotiations", and "secretary or purchasing department"; Beta: passive "inquiry about prices", and Gamma: "fiddling the prices", "air in the prices" (that is, there is a "correct" price). These repeatedly employed wordings suggest that the speakers regard the potential results of the PSM function's participation as relatively negligible.

PSM was given only an operational role in Alpha and Beta, but in Gamma an insight of strategicity was evolving. Interview observations and other data in each case company indicate that PSM had been expected to have only a marginal influence on costs; for example, only transactional measures employed on external resources, late involvement of purchasing in supplier selections, and localization of purchasing.

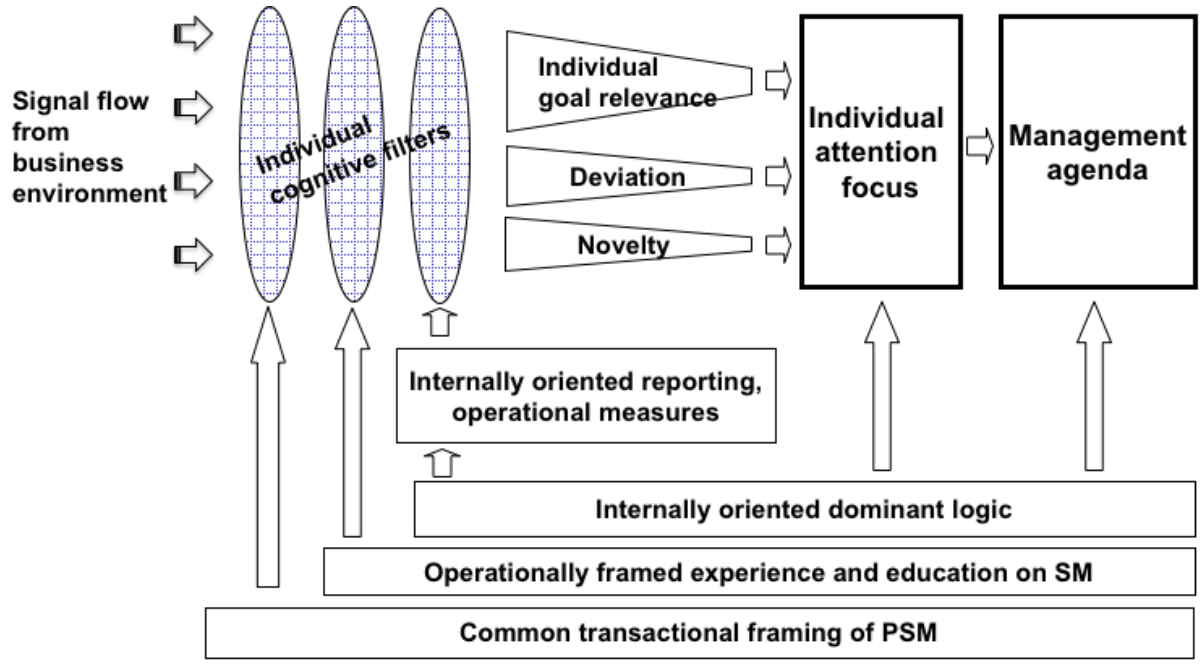
Herbert Simon refers to "hammers" of the decision maker, based on his/her history and experience (Simon 1997, pp. 298-302). In the case firms, "routine" negotiations (Alpha), passive inquiry about prices (Beta), and empty bargaining (Gamma) seemed to be perceived as the "hammers" of PSM.

PSM-related norms in the case companies, PSM-related terminology and habits (practices and processes), and management's expectancies regarding PSM would indicate that in the minds of the interviewees PSM was framed as an operational, transactional activity. The framing of PSM as such leads to external resource related problems being understood and handled as transactional only. Even the new title of CPO in Gamma was understood in practice as Chief Purchasing Officer, still indicating traces of traditional orientation.

Proposition 4: Transactional common terminology frames the role of PSM as operational and creates a barrier to cognition of the strategic opportunities offered by SM and external resources.

Conclusions

The presented propositions are the most probable explanations for the empirical observations in the light of the selected streams of managerial cognition literature. The explanations are sufficient, but not necessary cause of the observations. The propositions are summarized and integrated with the literature-based framework in the following picture 3:



Picture 3. Detailed model of issues influencing an SSM-related signal's rise to management's attention. Empirical findings are integrated with a model based on Hambrick et al. 1984, Nadkarni et al. 2008 and other literature on management cognition. Modified from Iloranta 2016.

Signals from environment are filtered through individual cognitive filter, which frames all PSM-related issues as transactional / operational. As such they are not identified to influence on individual goals nor deviate from usual. The transactional framing is based on general transactional terminology and framing of PSM, transactionally and operationally framed education and experience on PSM, internally oriented dominant logics of management, maintained through fragmented, internally oriented reporting.

Discussion

The supply management literature suggests that supply management has a natural strategic role within an industrial company because of the strong influence on a firm's performance (e.g. Axelsson 2005; Chen, Paulraj & Lado 2004; Gunasekaran, Patel & McGaughey 2004; Hughes, Day, & Hughes 2005; Hall 2000; Laseter 1998; Rajagopal & Bernard 1994; Giunipero, Handfield & Eltantawy 2006; Schiele 2007; Trent 2007; Iloranta & Pajunen-Muhonen 2008/2012/2015; Hoffmann 2010). Previous literature further maintais that top management

understanding, support and commitment are crucial for the successful transformation of purchasing's role towards that strategic role (Rajagopal & Bernard 1994; Hughes et al 2005; Schiele 2007; Trent 2007). However, it is still arguet that executives do not fully recognize SM's link to the firm's long-term performance, i.e. cognition of the strategicity of SM (Hofmann 2010, Hughes et al. (2005).

This paper addresses this problem and identifies several mechanisms that create barriers to top management cognition of SM's strategic opportunities and more generally the strategic role of external resources.

The novelty of this research lies firstly in the top management perspective on SM, and secondly in the cognitive views on supply management-related decision making. The existing supply management literature does not offer frameworks for these issues. Even the most fresh managerial textbooks on SM tend to maintain a functional (and rational) view although emphasize the increasing strategicity of SM (e.g. Chick and Hanfield 2015). Bendoly, Croson, Goncalves, and Schultz (2010) pointed out that case studies on cognitive psychology are rare within operations management. Approaching cognitive barriers through analysis of top management's perceptions of SM will thus contribute to filling also this broader gap.

Linking cognition literature with SSM related decisions of top management opens also broader tracks towards behavioral PSM and external resource management. Education and experience constitute the background of any human decision in any position, heavily influenced by common world views, industry beliefs and the organization's dominant logics, which have born for very different environments. International reporting norms and practices seem still to be based on production oriented concepts of a firm, which can be questioned in our globally networked business environments. It would also be interesting to learn, how generalizable the suggested mechanisms are as barriers to any adaptation to evolutionary changes in business environment, especially adaptation to slow changes like the underlying driver of the studied change, the growth of the share of a firm's external resources compared to internal (from 20% to 80% during hundred years).

The explanatory suggestions of this paper should be further tested and validated in broader contexts. The empirical part of this research was made during years, when the phenomenon to be studied was still clearly visible in midsize and even large industrial companies. The situation in the business environment generally as well as in the case companies has evolved remarkably since the interviews for 8 years ago. However, the key contribution of this paper are plausible potential explanations for the top management's slowness in recognition of SSM, which is still today very visible in many organizations.

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The role of Supply Chain Information Integration in building Supply Chain Resilience

Abstract

Through the usage of the CRBV of the firm, this study aims at analyzing the relationships between resources (strategic information sharing and information technology), capabilities (formative resilience elements) and performance (supply chain resilience). In addition, supply base complexity is adopted as a moderating factor. The theoretical model has been tested and survey data has been collected from 235 companies. The obtained results suggest that the bundle between resources leads to the development of resilient capabilities. Of these, only two enhance resilience in the supply chain. Regarding supply base complexity, only scale complexity has shown to have moderating effects.

Keywords: Supply Chain Resilience; Supply Chain Information Integration; Contingent Resource Based View

Submission category: Competitive paper

1. Introduction

The last disastrous events occurred in recent years have changed the concept of "business as usual" for many companies (Christopher and Peck, 2004). Disruptions have severely damaged the capability of the firms to produce and deliver their products, but have also highlighted the need for developing more effective supply chains (SC), able to cope and quickly recover from these events. Even relying on the most controlled internal processes, modern supply chains depend on different players spread across different countries or even continents in the world. The flows of information and products go through the nodes of these networks that link firms, industries and economies (Christopher and Peck, 2004). This spatial complexity (Choi and Hang, 2002), together with the adoption of practices aimed at increasing the cost efficiency (e.g. lean manufacturing initiatives or single sourcing policies) without leaving spare capacity for unexpected events, establishes the basis for a high supply chain risk as well as a key precursor for severe disruptions (Tang, 2006). Despite firms cannot completely avoid the likelihood of disruptive events whose consequences can seriously affect performance (Blackhurst *et al*. 2005), there are some actions that could be implemented to reduce their probability as well as the vulnerability to risks. In this highly complex context, the idea of building resilient supply chains, defined as "*the ability of supply chain to return to its original state or move to a new, more desirable state after being disturbed*" (Christopher and Peck, 2004, p.2), has gained support (Brandon-Jones *et al.* 2014).

Despite the complex environment, that has underlined the importance of building resilience, there are other practices, mostly adopted under "normal" conditions, whose outcome could support supply chains in facing disruptive events. One of these is supply chain integration. Many authors have expressed diverging opinions regarding the relationships between supply chain integration and resilience. In this regard, the aim of this study is to make clearer this connection by focusing on the Supply Chain Information Integration dimension in its two components of strategic information sharing and information technology (Prajogo and Olhager, 2012), whose effects will be studied in relationship to supply chain resilience and its formative elements. To achieve this purpose, this study will be drawn on the Contingent Resource Based View (RBV) of the firm (Barney 1986,1991), whose usage is aimed at addressing the issue of "context insensitivity" (Ling-yee, 2007, p.370) of the RBV. In particular, the vision of complementary relationship between resources (Amit and Schoemaker, 1993) will be adopted. Therefore, following the CRBV schema, the relationship between resources (strategic information sharing and information technology), capabilities (the four resilience capabilities identified by Juttner and Maklan (2011)), performance (supply chain resilience) and contingencies (supply base complexity), will be analysed.

By extending the findings of Brandon-Jones et al. (2014) and by empirically investigating the relationship between IT and strategic information sharing, this study aims to deeply analyze the outcome given by the complementarity between these two resources in terms of the resilience

capabilities identified by Juttner and Maklan (2011). The model obtained from this analysis could be used as a blueprint for future studies concerning the impact supply chain information integration in terms of supply chain resilience. In this way, it would be possible to advise managers in creating an information sharing culture where the exchange of meaningful information magnifies the value of IT, while the connectivity, enabled by technological infrastructure, supports coordination by providing supply chain partners with right and timely information, once needed. The remainder of this paper is organized as follows: Section 2 describes the theoretical background; Section 3 depicts the theoretical framework together with the developed hypotheses; Section 4 describes the applied methodology; results are analysed in section 5; finally, Section 6 depicts the main conclusions and directions for future research.

2. Theoretical Background

Supply Chain Information Integration and Supply Chain Resilience

Flynn et al. (2010, p. 59) define the Supply Chain Integration *as "the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages inter and intra-organizational processes"*. The Literature on this topic is characterized by several dimensions and definitions (Van der Vaart and van Donk, 2008). One of these identifies the existence of two flows along the chain: goods and information (Pagell, 2004). The first is related to the concept of Logistics Integration while the latter flow is linked to the Information integration, which deals with the share of key information throughout the supply chain network by means of information technology (IT) (Prajogo and Olhager, 2012). The concept of supply chain integration has been mostly focused on the achievement of the performance of the firm under normal conditions, without considering its potential implications on the dimension of supply chain resilience. However, some studies have started to debate about the role of integration in case of disruptive events and its relationship with supply chain resilience. On the one hand, some authors state that integrated chains are more vulnerable since a disruption in one node may affect the entire network; on the other hand, some studies state that tightly coupled chains could better react to disruptive events (Scholten et al., 2014). Wieland and Wallenburg (2013) analysed the interaction between three relational competences (communication, cooperation and integration) in relationship to the supply chain resilience. Their findings underlined that the combined effects of communication (transmission process and flow of explicit information (Modi and Mabert, 2007)) and cooperation (process by which individuals interact and create psychological connections for gaining mutual benefits (Smith *et al.*,1995)), would have concealed the effect of integration as enhancer of resilience. The reasons were that mutual dependencies, tied-up resources and restricted flexibility would have neutralized the positive effects of integration. However, the results of Wieland and Wallenburg (2013) were affected by a too broadly perspective of integration. Indeed, as stated by the same authors, other aspects of the concept could have given different results. Starting from this consideration, this study adopts, as a reference, the specific dimension of Supply Chain Information Integration (SCII) (Prajogo and Olhager, 2012). Its two components, information technology and information sharing, have been mostly studied separately in relationship to supply chain resilience. For example, Christopher and Lee (2004), through the usage of the "risk spiral", stated that information sharing was the key to improve supply chain visibility, seen as a crucial element in reducing risk exposure. However, despite the quality, accessibility and accuracy of information (Cao and Zhang, 2011), the support of technological means for ensuring the effective delivery and processing of data is required (Fawcett *et al.*, 2007). Regarding the role of information technology, Blackhurst *et al.* (2011) underlined that the presence of technologies, able to increase the visibility in the supply chain, would have represented an enhancer of supply chain resilience. These contributions from the existing literature have given rise to the following research question to which this study aims to answer: *should be the effects of information sharing and information technology analysed separately in relationship to supply chain resilience or the impact could be enhanced through their integration?*

The complementary perspective in the RBV

According to the Resource Based View (RBV), organizations can achieve a superior competitive advantage by combining strategic resources and/or capabilities with certain characteristics (Barney, 1991). In particular, the creation of competitive advantage starts from bundling resources that are valuable, rare, imperfectly imitable and non-substitutable (Grant, 1991). Focusing on IT, some authors argue that these technology assets are unlikely to respect all the aforementioned characteristics (Mata et al., 1995). However, within the RBV it is possible to notice a specific view regarding this topic. If the firm owns IT resources that do not constitute a distinctive source of competitive advantage and if these resources are instead used to leverage the full competitive advantage of valuable, costly to imitate and rare non-IT resources, then IT can be considered an enhancer of the competitive advantage of the firm. This last view is in line with the notion of complementary relationships. Complementarities represent an increase in the resource value and arise once the resource produces a greater outcome in the presence of another resource than it does alone (Mishra and Shah, 2009). Many authors have been influenced by the complementarity perspective, due to the idea that co-specialization among complementary resources may have beneficial effects (Teece, 1986). For example, Powell and Dent-Micallef (1997) stated that the sole usage of IT does not explain a distinctive variance in the competitive advantage achieved by the firm, whereas the firms can be analysed by their ability of combining explicit technological resources (IT) with other human or business resources to gain competitive advantage. These last resources are represented by strategic information sharing defined as "the willingness to make strategic and tactical data available to other members of the supply chain" (Mentzer, 2001, p.8). This study aims to be aligned with the previous perspective regarding the complementary role of IT but at the same time it wants to go beyond the simple recognition of the potential positive effects of IT over no-IT resources. Indeed, addressing Black and Boal (1994), the need to open the "black box" of organizations is pointed out in order to examine the bundle in which IT resources are included and more precisely the nature of the relationships among resources that make up the bundle. Finally, this bundle of resources and its intrinsic relationships will be considered under the broader notion of Supply Chain Information Integration (Prajogo and Olhager, 2012). Indeed, this concept enhances the fit (a term that has been largely used in the literature as synonymous of complementarity) between the exchange of strategic information and the information technology. It has to be remarked that these types of resources need to be jointly considered in order to fully understand the competitive advantage generated. The adopted dimension of integration will be the external rather than the internal one, and in particular, within the external integration, the focus will be mainly on the supplier side.

The usage of the Contingent Resource Based View (CRBV)

Kraaijenbrink et al. have argued that "*the moment in which we try to explain or predict the firm's actual performance, the RBV turns out to be incomplete since it ignores the material contingencies' of the firm's situation*" (2010, p.365). This means that the theory is not able to identify the conditions in which both resources and capabilities may be optimised (Ling-yee, 2007). In this regard, the contingency theory states that both external and internal conditions may influence the way in which an organization or supply chain is managed (Grotsch et al.,2013). Hence, also the resources and capabilities needed for driving the performance of the supply chain in certain circumstances may be affected (Brandon-Jones et al., 2014). Many scholars have suggested that the static nature of the RBV can be addressed by the usage of a contingent RBV (Brandon-Jones et al., 2014). The adoption of this view could help to recognize to which extent resources and capabilities may create value (Aragòn-Correa and Sharma, 2003), to enhance the usefulness of the RBV (Brush and Artz,1999) and lastly to identify the conditions that affect the utility of certain resources and capabilities (Brandon-Jones et al., 2014). The contingencies adopted in this study are represented by supply base complexity factors.

3. Theoretical Framework and Hypothesis Development

Supply Chain Resilience

Ponomarov and Holcomb (2009, p.131) defined supply chain resilience as "*the adaptive capability of a supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function*". Within this definition, it is possible to notice three distinct phases. The first phase deals with the period before the disruption, once some proactive strategies need to be implemented, such as the development of collaborative activities with supply chain actors as well as the building of capabilities aimed at increasing visibility in the supply chain. The second and third phases deal with responding to and recovering from a disruption that has hit the supply chain. In this case, the implementation of reactive strategies is needed. These stress the need of velocity, thus the need of less time and highly efficient practices to quickly recover from the disruption. Furthermore, the willing of "maintaining continuity of operations" enhances the need of flexible resources, while "the control over structure and function" can be ensured through the continuous exchange of information with supply chain partners. To summarize, this definition clearly identifies several underlying elements of supply chain resilience during the distinct phases of preparation, response and recovery. In addition, these elements are captured at a capability level (Ponomarov and Holcomb,2009; Juttner and Maklan, 2011).

Despite in the literature no conceptual differences are evident among the phases in which the supply chain resilience is operationalized, the perspective on the resilience formative elements is still affected by some overlaps (Juttner and Maklan, 2011; Scholten et al., 2014). The concepts of efficiency, redundancy, collaboration, flexibility, velocity, visibility and robustness are used in relationship to supply chain resilience (Christopher and Peck, 2004; Sheffi and Rice, 2005; Ponomarov and Holcomb, 2009; Pettit et al., 2010,2013; Blackhurst et al., 2011; Juttner and Maklan, 2011; Wieland and Wallenburg, 2012,2013). Among the previously identified strategies, supply chain visibility, flexibility, velocity and collaboration are the most commonly mentioned and the ones that better capture the essence of all the consideration regarding the resilience formative elements (Juttner and Maklan, 2011). Therefore, in line with Juttner and Maklan (2011), this study has considered these four as the formative elements of resilience. In this regard, supply chain resilience is seen as a performance outcome of these capabilities. The line of reasoning, can be formulated as follows. The aforementioned four capabilities, which stem from complex interactions between resources, are the mechanisms that mitigate the impact of disruptions. Their development and exploitation before or after a disruption, can significantly reduce its overall impact that can be measured in terms of supply chain resilience. Therefore, by considering resilience as a performance with its consequent measures, it is possible to state to which extent the exploitation of capabilities could protect or create value. The longer the time the supply chain takes to develop these capabilities, the more the disruption impact grows and negatively affect supply chain. In this regard, resilience performance has been measured at the operational level in terms of the time required to return to the original state of operating performance or also the time taken to restore the flow of materials after a disruptive event. This is in agreement with other authors, such as Blackhurst et al. (2011) and Brandon-Jones et al. (2014), who also adopted the RBV in their research and considered resilience as a performance outcome.

The impact of Supply Chain Information Integration on Supply Chain Resilience

Frequently in literature, there has been a lack of a clear distinction between the concepts of information sharing and visibility (Barratt and Oke, 2007). While information sharing is related to the quality, accessibility, strategic relevance of the information exchanged between the supply chain actors (Cao and Zhang, 2011), visibility is predominantly concerned with information flows in a given time in terms of: inventory levels both upstream and downstream in the supply chain, demand and supply conditions, and production and purchasing schedules (Christopher and Peck, 2004). Visibility contributes to have a clear view of all the aforementioned factors, thus allowing the supply chain to be more transparent (Christopher and Lee, 2004). The continuous exchange of accurate information

between supply chain partners, contributes to increase supply chain visibility (Chirstopher and Lee, 2004); the type of information shared (e.g. inventory, orders, market trends etc.), its frequency and the direction play a fundamental role in the achievement of this capability (Scholten et al., 2015). Naturally, in order to ensure information sharing, organizations need to create the right technological linkages across the supply chain aimed at enhancing visibility in their operations (Mabert and Venkataramanan, 1998). In this regard, information technology systems, which are related to the tangible resources, provide the platform for enhancing supply chain visibility (Brandon-Jones et al., 2014). Information Technology provides real-time information regarding the inventory level, the delivery status, the production planning and scheduling, thus enabling the firms to improve the management of their activities (Prajogo and Olhager., 2011). The availability of this information in a timely manner, by means of technological infrastructure, contributes to increase the transparency in the supply chain and thus visibility. Furthermore, some studies have highlighted that IT positively contributes in enhancing the level of integration between supply chain partners (Soliman and Youssef, 2001). In turn, this integration inhibits the presence of "functional silos" and further enhances the free flow of strategic information between organizations (Christopher and Peck, 2004). This information integration, in which the exchange of meaningful information is supported and improved by the technological infrastructure, represents an integrated bundle which improves the impact on the visibility of the two resources that constitute it. By developing supply chain visibility, firms are able to reduce both the likelihood and impact of disruptions (Christopher and Lee, 2004a) and therefore to enhance resilience (Juttner and Maklan, 2011). This is confirmed by several authors who have underlined the role of supply chain visibility in developing supply chain resilience (Blackhurst et al., 2011; Juttner and Maklan, 2011; Wilding, 2013; Brandon-Jones et al., 2014). For example, Tang (2006) states that visibility can enable supply chain partners to create a common demand forecast that, associated with the proper restoration rule, could ensure the return to normal levels of inventory after a disruptive event. Therefore, especially in the case of disruptions, the supply chain can return to its normal state of performance if all its members have the proper visibility. In the light of what stated above, the following hypotheses may be formulated:

H1a: Supply Chain Information Integration has a positive effect on Supply Chain Visibility
H2a: Supply Chain Visibility is positively related to Supply Chain Resilience

Through investments in information technology, it is possible to create an important enabler for a unique collaboration between supply chain partners. Indeed, the partners are tied together and thus are more willing to send signals about unexpected changes in the supply chain as well as to improve both their own and joint processes (Wieland and Wallenburg, 2012). This mutual dependency has been shown to positively affect the degree of collaboration between supply chain actors (Scholten et al., 2015). However, following the RBV perspective, a collaboration capability is rare, valuable and hard to replicate (Fawcett et al., 2007; Richey et al., 2010). The building of productive relationships is the basis for an effective collaboration between supply chain partners and the strength of these supply chain relationships is enhanced if information technology and the willing of sharing strategic information simultaneously exist (Frohlic and Westbrook, 2001; Min, Mentzer and Ladd, 2007; Fawcett et al., 2011). In this regard, by jointly considering the effects of strategic information sharing and information technology from the perspective of supply chain information integration, the benefits in terms of long-term collaboration may be enhanced. Indeed, information integration provides not only the availability of information in a timely manner (Wong et al., 2011), but also the transparency of decisions, a key factor in the development of a long-term collaboration. The development of collaborative activities between organizations makes the network integrated and contributes to have a holistic approach, essential for building supply chain resilience (Scholten et al., 2014). Indeed, collaboration plays a fundamental role not only before a disruptive event but also after it, in order to share, among the parties, the experiences useful to increase the ability of the system to deal with future threats (Juttner and Maklan, 2011; Sheffi, 2005). Given the above, in the case of disruptions,

supply chain resilience cannot be achieved without the strict participation of the supply chain members who are called to collaborate and respond in a synergistic manner (Juttner and Maklan, 2011; Ponomarov and Holcomb, 2009).Therefore:

H1b: Supply Chain Information Integration has a positive effect on Supply Chain Collaboration
H2b: Supply Chain Collaboration is positively related to Supply Chain Resilience

In order to achieve velocity, firms need to reduce the so-called "end-to-end" pipeline time that is the time required for moving products, materials and information from one side of the supply chain to the other, being able to react to upwards or downwards changes in the demand. Through investments in integrated systems, the interchange of data, and consequently processes, can be accelerated. As a consequence, the time-based performance of supply chains may be positively affected by the implementation of an information-intensive IT platform (Jayaram et al., 2010). These benefits provided by IT may be used in leveraging the ones resulting from the continuous exchange of strategic information between supply chain partners. Indeed, the prompt exchange of both tactical and strategic information in a timely manner, positively influences the event readiness of each member of the supply chain thereby increasing velocity and making the supply chain more resilient (Juttner and Maklan, 2011). According to Manuj and Mentzer (2008), three main dimensions of velocity can be identified: the rate at which a risk event occurs, the rate at which losses happen and finally the rate at which the risk event is discovered. The fourth dimension is added by Juttner and Maklan (2011) who identify velocity, in the context of supply chain resilience, as the capability to recover and respond to a disruption. This final dimension underlines the importance of velocity before, during and after a disruption and further stresses how supply chain velocity is a fundamental element in order to increase supply chain resilience, given its contribution to increase the speed of recovery from a disruption (Mandal et al., 2015).

H1c: Supply Chain Information Integration has a positive effect on Supply Chain Velocity
H2c: Supply Chain Velocity is positively related to Supply Chain Resilience

The real-time connectivity enabled by technological infrastructure may provide less-tangible benefits such as the managers' capability to predict possible environmental trends and inflection points (McGee, 2004). By being capable to detect changes in demand, requirements or even (potential) disruptions in the supply chain, companies could, for example, react through changes in the product mix, or more generally act upon these changes (Swafford et al., 2008). Therefore, the presence of IT enhances the capability to alter the product flows of the firm, which in turns leads to a higher degree of readiness to potential disruptions and thus increase supply chain flexibility. However, the reliance on technology without the willing of sharing information related to supply chain activities will make firms not meaningfully integrated and thus not capable of achieving superior performance (Prajogo and Olhager, 2012). Information sharing within the supply chain may create flexibility, but it has to be accurate and timely (Jarrell, 1998). This is in line with Scholten et al. (2015) and with Chan et al. (2009), who found that receiving the right information too late could negatively affect the flexibility dimension to face upcoming disruptions. The underlying reason was that if information is received too late, the production schedules are already fixed and the level of stocks are already set, thus enhancing the impact of disruptions. Therefore, the achievement of flexibility is enhanced by the integration of strategic information sharing and information technology. The development of flexibility is related to the organic capability that helps the supply chain in detecting potential disruptions and emergency plans (Sheffi and Rice, 2005). In this regard, it can also be defined as the ability to have different positions and rapidly face potential changes in the supply chain (Lee, 2004). Having flexibility has been detected by many authors (Tang, 2006) as an enhancer of SC resilience. Very often supply chain flexibility and velocity are grouped under the broader concept of supply chain agility (Christopher and Peck, 2004b). Despite the speed of recovery is important, much more

important is the knowledge of the potential configurations that guide the recovery process and thus the flexibility of the system (Mandal et a., 2015). What stated above leads to the formulation of the following hypotheses:

H1d: Supply Chain Information Integration has a positive effect on Supply Chain Flexibility
H2d: Supply Chain Flexibility is positively related to Supply Chain Resilience

The moderating effect of Supply Base Complexity on Supply Chain Resilience
Supply base complexity is linked to the complexity that arises in the upstream part of the supply chain. Three main dimensions have been adopted in this study: scale complexity (number of suppliers), delivery complexity and geographical dispersion of the supply base.
A supply chain characterized by a high number of suppliers is more exposed to unreliable deliveries (Choi and Krause, 2006). Smith et al. (1991) showed that scale complexity reduces the level of responsiveness, as the transmission of information between the actors of the chain becomes delayed or even blocked. Since the movement of physical goods is strictly related to the flows of information, delay in the latter may expose firm to disruptive events. Together with the number of suppliers, supply chains that experience long lead time or high unreliable suppliers' delivery are exposed to a high supply base complexity. This in turn may cause more frequent disruptions due to less rapid responses to changes in end-customer demand (Simangunsong et al., 2012) and less transparency along the chain (Brandon-Jones et al., 2014). Finally, a geographically dispersed supply base creates the basis for a truly global supply chain (Brandon-Jones et al., 2014). Global sourcing is often related to increased uncertainty and less transparency caused by trade restrictions, custom barriers, exchange rate fluctuations and institutional differences (Wagner and Bode, 2006), if compared to sourcing from local or domestic markets. Once the geographical distance increases, the coordination of activities between the buyer and its suppliers becomes costly and difficult.
Each dimension of complexity contributes in creating more uncertainty along the chain and therefore additional opportunities for resilience capabilities to benefit managers. Indeed, the uncertainties created by supply base complexity could enhance the effects of long-term collaboration, visibility, flexibility and velocity in reducing the likelihood of disruptive events and increasing the speed of response. For example, supply chain visibility improves supply chain information processing capacity and thus positively contributes to better information collection, flows and accuracy (Tushman and Nadler, 1978). The benefits of visibility are particularly helpful when there is a high degree of scale complexity, due to the increase in the information to be processed as the number of actors within the network increases as well. Accordingly, the benefits of long term collaboration may be enhanced by the presence of a high degree of complexity. Both market and technological issues may be effectively dealt through specific long term partnerships where supply chain actors share information regarding unexpected events and developments (Verwaal and Hesselmans, 2004). Furthermore, the collaborative communication between partners positively contributes in reducing behavioural uncertainty (Wuyts and Geyskens, 2005). Finally, the sensing of supply chain disruptions, that is one of the major characteristics of supply chain flexibility (Sheffi and Rice, 2005), may be fully exploited once the transparency along the chain is obscured by a high degree of supply base complexity. Firms can improve their ability to sense disruptions through activities such as monitoring, auditing and certifying suppliers. If the complexity of the supply base is high, the return from such activities is particularly enhanced.
Therefore, the following hypotheses can be formulated:

H3a,b,c,d: Supply base complexity positively moderates the relationship between SC visibility, LT Collaboration, SC velocity, SC flexibility and supply chain resilience: the higher the complexity, the greater the beneficial effects on resilience

The following image (Fig.1) depicts the theoretical model with all the hypotheses previously explained.

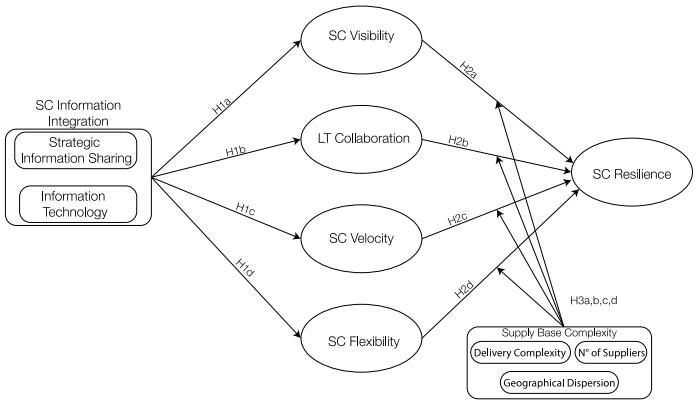

Fig.1: Theoretical model

4. Methodology

Sample and Data Collection

The data collection has been carried out through a survey which was developed by a group of students and academic experts of the University of Groningen, covering the topics such as supply chain complexity, resilience capabilities, supply chain resilience and supply chain integration. proper respondents have been identified within these professional figures: CEO, plant director, supply chain director or any other actor directly involved at a managerial level in the supply chain field. The companies involved in participating to the research project come from the manufacturing sector. In particular, the following sectors characterized by these NACE codes were involved: C.10-11, C.13, C.20, C.23, C.27, C.29-30.

A presentation letter has been prepared, in which the main topics and objectives of the research were concisely described. It was underlined that each respondent would have received the results of the research once completed. For the fulfillment of the survey, the period of time between the beginning of January and the beginning of March (10 weeks) was granted. In many cases, it has been necessary to make reminders through emails or phone calls (every 2 weeks). Once the survey was fulfilled by the companies, it has been sent an email of thanks for the participation to the project. A total of 107 Italian responses were received, accounting for a response rate of 20%. These were then added to the already existing database containing 129 responses from Chinese (95 responses) and Dutch (34 responses) respondents. All the proper tests have been pursued to validate that no differences were present among the Italian, Chinese and Dutch data.

Measures

This study uses the following constructs: information sharing, information technology, long term collaboration, supply chain visibility, supply chain flexibility, supply chain velocity and supply base complexity. The survey questions pertaining to these constructs were derived from valid and reliable extant research.

Information sharing and information technology were respectively measured by five and six items and were adapted to this work from Prajogo and Olhager (2012). The items of Information Sharing, limited to the supplier side, measure to which extent the exchange of information occurs between supply chain partners. Information technology items, always limited to the supplier side, measure to which extent information technology is adopted in the relationship between the focal firm and its supplier. The items used to measure supply chain visibility, flexibility and velocity were adapted to this work from Pettit et al. (2013). The items for supply chain visibility state the capability of the focal firm to know the status of the operating activities and the environment at one point. The items for supply chain flexibility are related to the capability of the firm to make changes in terms of order quantity, delivery time and production volume. The items for supply chain velocity were measured

in terms of "recovery", underlining the ability to return to the operational state rapidly and efficiently after disruptive events. Finally, the items used for measuring the supply base complexity were adopted from the work carried out by Bozarth et al. (2009). The selected items relate to the number of suppliers, the percentage of purchases made in the home country and the variances of supplier lead-time and supply reliability. A high level of these variables indicates a high level of supply base complexity. The survey items are developed by using the Linkert-scale, with values ranging from 1 ("strongly disagree") to 5 ("strongly agree"). To ensure the consistency of scaling, the items used for measuring supply base complexity are reversely recorded, so that the range goes from 1 (less complexity) to 5 (more complexity).

5. Analyses and results

This section describes the methodology adopted for conducting the statistical analysis of the data sample. Partial Least Squares – Path Modeling (PLS – PM) has been used for statistically validating the relationships between factors and variables; its development has been carried out through the package plspm of the software R.

Measurement model

In this study, the relationship between the latent variables (e.g. strategic information sharing, information technology, visibility, collaboration etc.) and their block of manifest variables has been considered reflective. The idea behind the reflective measurement model is that all the reflective indicators, also known as the block of manifest variables, are measuring the same latent variable and thus are the expression of the same construct. To evaluate the reflective measures, three aspects have to be considered: the unidimensionality of the indicators (Crobach's alpha, Dillon-Goldstein's rho, first eigenvalue), verify if the indicators are well explained by its latent variable (loadings and communalities) and finally assess the degree to which a given construct can be differentiated from another construct. The unidimensionality of the indicators has been confirmed by the outstanding values of the Cronbach-alpha and the Dillon- Goldstein' rho, both higher (for each construct) than the acceptable threshold of 0.7. Also the first eigenvalues, that in case of unidimensionality of the construct should be greater than one, were considered highly acceptable. Finally, all the factor loadings were closer to 0.7 or even higher, thus resulting to be acceptable. However, in order to make stronger the analyses conducted, it has been assessed the average variance extracted for all the constructs. For each latent variable, the AVE value was in excess of 0.50 thus supporting the convergent validity. The obtained results underline that each block of manifest variables was highly represented by the latent variable to which they are associated.

Structural Effects

This section shows the estimation results of the complementary effects of strategic information sharing and information technology, grouped under the concept of supply chain information integration, on the formative resilience elements as well as the impact of long term collaboration, velocity, flexibility and visibility on supply chain resilience.

The supply chain information integration, which comes from the interaction between strategic information sharing and information technology, has been estimated through the usage of the two-step approach (Agarwal and Karahanna,2000; Henseler et al. 2007). Figure E.2 shows the single effects of strategic information sharing and information technology over the formative resilience elements.

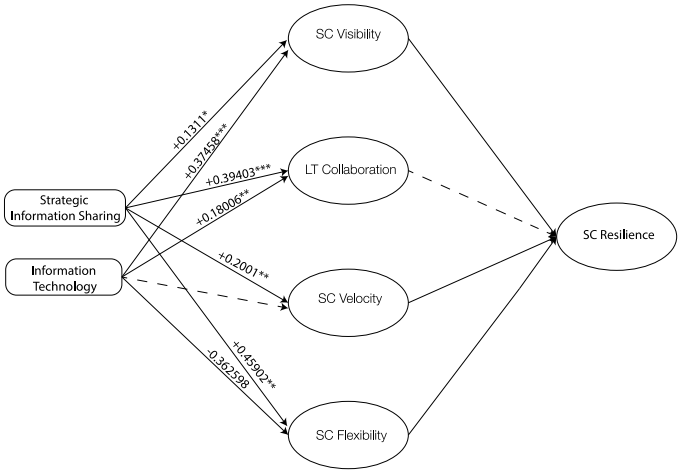

Fig.2: Impact of the single effects (significance at *p< .05, **p< .01, ***p< .001, p< .10)

When testing H1a,b,c,d the path coefficients for the interaction term (Strategic Information Sharing x Information Technology) and the formative resilience elements were all positive and significant, as it is showed in the Figure 3. This result was already anticipated in the first-step of the methodology in which the effects of the single resources turned out to be both positive and significant for most of the relationships. In the light of what stated above, the previously mentioned positive effects provide support for H1a,b,c,d.

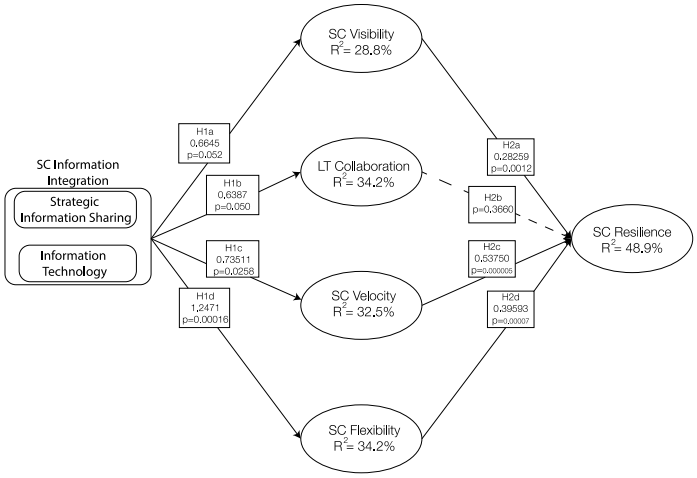

Fig.3: Impact of Supply Chain Information Integration

Turning to H2a,b,c,d, regarding the effects of the formative elements on supply chain resilience, it may be noticed that the p-values are all significant with the exception of H7 (p-value >0.1). Therefore, from the results obtained it can be stated how supply chain visibility, flexibility and velocity are positively related to supply chain resilience, while the same cannot be stated for long term collaboration.

When testing the proposed moderating effects between supply base complexity and the formative resilience elements in relationship to supply chain resilience, the product indicator has been applied (Busemeyer and Jones, 1983; Kenny and Judd, 1984). Each of the supply base variables (number of suppliers, geographical dispersion and delivery complexity) have been multiplied for each capability (visibility, flexibility, velocity and LT collaboration), thus obtaining 12 different terms. It was hypothesized that the formative resilience capabilities would have been enhanced in case of supply base complexity and, as showed by results, this was confirmed only in two cases. Indeed, the positive impact of supply chain visibility on supply chain resilience was slightly higher for high scale complexity (p-value:0.0475; coeff.:+0.325). A high degree of delivery complexity negatively affected the relationship between long term collaboration and supply chain resilience. In other words,

the impact of long term collaboration on resilience is low when delivery complexity is higher (p-value: 0.04; coeff.: -2.569).

6. Discussion of the results and directions for future research

Some important considerations could be deduced from the obtained results. Supply chain information integration helps firms in conducting not only the day-by-day business activities but also helps in the development of resilient capabilities. Indeed, the sharing of strategic information between the actors is strongly supported by the proper technological infrastructure, thus making possible the availability of strategic data in a timely manner. In turn, this allows to constantly control the supply chain, to forewarn possible threats in one node and to speed up the measures to be adopted in case of disruptions. All these outcomes are positively related to resilient capabilities and underline that specific forms of integration may enhance resilience in the chain, as also suggested by Wieland and Wallenburg (2012). This result is even more interesting by considering that survey data has been used to test these hypothesized relationships, making this study one of the few in empirically contributing to the literature on supply chain resilience. Firms need to understand the importance of sharing both strategic and tactical information that could magnify the returns from investments in the scope of IT applications and, consequently, develop capabilities for overcoming or recovering from disruptive events. Inability in recognizing complementary interactions, hardly discussed in the RBV, may lead to unnecessary overemphasis and could dampen the net impact of some investments. Therefore, managers should include these considerations into their decision-making process and, moreover, should also understand that resources typically used for the daily business activities (e.g. strategic information sharing and information technology) may be integrated for making the supply chain more resilient.

In terms of capabilities, the obtained results suggest that the effects of information integration, in its two components of strategic information sharing and information technology, are positively related to supply chain resilience capabilities; most of them were the positively related to SC resilience. Through the transparency (due to the exchange of strategic information) and the fast elaboration of strategic data mixed to systems able to monitor events along the chain (due to the technological infrastructure), it is possible to improve reactions, take effective decisions and all the necessary interventions in managing a risky event. These elements represent the foundation of supply chain visibility and their positive connection to supply chain resilience has been demonstrated by several authors (Blackhurst et al., 2011; Juttner and Maklan, 2011; Azadeh et al., 2014).

Supply chain information integration, as well as its principal components, has been shown to be positively related to long-term collaboration. Indeed, sharing information increases transparency and trust (Bhamra et al., 2011) that are considered enhancers of long-term relationship and cooperation across partners in the chain (Faisal et al., 2007). Furthermore, if this information is supported by technological platforms that allow the real-time exchange (Boyson et al., 2003), the collaboration is further enhanced as every actor can efficiently and effectively receive relevant information efficiently and effectively (Mandal, 2012). However, the capability resulting from the integration among resources, turned out to be not statistically significant in relationship to supply chain resilience. The reasons of this result, rely in the choice of the construct used for measuring collaboration and, in particular, in its aspect of using fewer suppliers over a longer period instead of maintaining a large supply base (Helper, 1991). This element could positively contribute to enhance the relationship between the focal firm and its suppliers but, at the time of a disruption, the choice of limiting the supply base could negatively affect supply chain vulnerability (Cavinato, 2004; Choi and Krause, 2006; Svensson, 2004). In this regard, future studies could investigate the role of long-term collaboration as an antecedent of the resilient capabilities identified by Juttner and Maklan (2011).

With regards to supply chain velocity, while the willing of sharing strategic information has been positively related to speed, the same did not happen for the only presence of information technology.If information technology supports the early sharing of strategic information among the actors, the integration among these two resources enhances the lead-time in responding but it also allows to have

enough time for developing countermeasures in case of disruptive events. The negative impact of information technology has been found in the case of supply chain flexibility, similarly to supply chain velocity. This is in line with the findings of Wieland and Wallenburg (2013) who considered information technology infrastructure as integrated systems able to accelerate the interchange of data. The authors found that tight coupling of resources and integrated systems would have impeded a quick reaction to unpredictable events that would have required, for example, the change of suppliers. Nevertheless, as also stated by the authors, the concept of integration adopted in their research did not consider the communication among the actors, which was intended as the formal and informal exchange of meaningful and timely information. By jointly considering strategic information sharing and information technology, grouped under supply chain information integration, the benefits in terms of supply chain flexibility are enhanced. Indeed, information technology provides the platform for accelerating the flow of strategic information. This enhancement in flexibility derived from information integration, is measured along two dimensions that, in turn, affect the supply chain resilience. The first deals with the capability of rapidly meeting new demands (in terms of product type and quantities), whereas the second is instead the ability to reconfigure the supply chain by flexibly taking decisions in terms of switching supplier, change delivery times etc. By knowing exactly what is happening in each node of the chain in terms of production conditions through constant and fast flows of information, the focal firm is able to better manage internal changes as well as timely switch the supplier in case of disruptive events.

Many hypotheses have been rejected due to the non-significant moderation influence of supply base complexity on the direct relationships between the formative resilience capabilities and supply chain resilience. The only exceptions are represented by two interactions. The first deals with the positive and significant effect of supply chain visibility on supply chain resilience in case of a high degree of scale complexity (number of suppliers) (p-value=0.0475; estimate=0.325). For firms operating in this context, it has been shown that investments in supply chain visibility would have given a superior outcome in terms of supply chain resilience. Scale complexity might lead to more frequent disruptions due to a higher number of nodes in the supply network and, therefore, an increased likelihood of propagation of disruptions. In turn, disruptions are events that limit the ability to work in a pre-determined manner (Craighead et al., 2007) and increase the information processing requirements of an organization. In this regard, the creation of greater visibility in the supply chain would contribute in enhancing the information processing capacity of the organization. The second significant interaction is related to the negative impact of delivery complexity on the relationship between long-term collaboration and supply chain resilience. Delivery complexity is associated with more frequent disruptions due to the greater distance to be travelled (Stecke and Kumar, 2009), demand amplifications effects (Lee et al., 1997) and less rapid responses to changes (Simangunsong et al., 2012). In addition, as suggested by Brandon-Jones et al. (2012), long lead time supply chains may be characterized by having less transparency and thus being subjected to more frequent disruptions. These elements can explain the obtained result. Among all, the lack of transparency in the chain could cause uncertainty. This, in turn, is viewed as one of the underlying determinants of high transaction costs (Williamson, 1975) that undermine the relationships among actors. Building long-term relationship with a reduced number of suppliers does not affect the development of resilience, but if this limited group is also characterized by a high delivery complexity, then the management of disruptions will be even negatively affected. Finally, supply chain velocity and supply chain flexibility have not been affected by any supply base complexity factors in relationship to supply chain resilience. This could mean that these capabilities are always helpful in any work condition in which the firm works since they effectively help in reducing both time and cost of disruptions and, thus, enhancing supply chain resilience. For this reason, future studies could investigate new contingency factors and their moderation in the effects of resilient capabilities.

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Coordinating model of working capital management: developing economic sustainability from the inside

Anastasiia Ivakina and Nikolay Zenkevich

St Petersburg State University, Russia

Summary
The paper is devoted to development of a working capital management model providing optimal levels of working capital (WC) to all individual business partners in a supply chain (SC) through collaborative actions of capital reallocation. As such, we suggest the tool of WC optimization through financial terms and cash flows verified on Russian collaborative SC data. Mathematical modeling is suggested as a method to upgrade existing collaborative cash conversion cycle (CCC) model (Hoffman and Kotzab, 2010) by optimizing it for a three-stage SC. The application of the suggested optimization model to focal SC provided significant acceleration of individual CCCs and investments in WC by combining the extension of days of accounts payable, reduction in days of inventories and reduction in days of accounts receivable in different proportions for SC participants. The theoretical contribution consists of integrating collaboration and WC concepts, adding a holistic perspective to extant working capital management (WCM) models. The suggested model illustrates financially the motivation of SC partners to cooperate in order to simultaneously achieve target levels of WC investments and improve individual financial performance through collaborative operations.

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Keywords
Supply Chain Finance, Working Capital Management, Supply Chain Coordination

Introduction and area of investigation

Supply chain finance (SCF) and working capital management (WCM) are increasingly recognized as important means of liquidity and profitability improvement, specifically in terms of globalization and growing competition between supply chains (SCs) (Deloof, 2003; García-Teruel and Martínez-Solano, 2007; Lazaridis and Tryfonidis, 2006). The physical product and information flows have long been addressed by researchers and practitioners, unlike the upstream and downstream flows of money (Gupta and Dutta, 2011; Kouvelis et al., 2006; Weiss, 2011; Wuttke, Blome and Henke, 2013), although rising financial risk in SCs stimulated management to recognize that the financial side of supply chain management (SCM) is a promising area for improvements. Nevertheless, companies still focus on their individual SC issues and take their own interests into account rather than understanding the whole SC and coordinating with their partners.

As business environment is swiftly changing and competition levels rise, Gupta and Dutta (2011, p.47) emphasise that “for an effective supply chain system, the management of upstream flow of money is as important as the management of downstream flow of goods”. From this perspective, working capital management (WCM) as an essential element of

financial supply chain management (FSCM) has gained a lot of attention (Deloof, 2003; García-Teruel and Martínez-Solano, 2007; Johnson and Templar, 2011; Matyac, 2015; Protopappa-Sieke and Seifert, 2016; Shin and Soenen, 1998; Viskari et al., 2011; Viskari et al., 2012; Viskari and Karri, 2012;) since the financial crisis of 2008. WCM is stated to be a way to accelerate the cycle time of working capital and increase the profitability and liquidity of the company in respond to spreading volatility in business environment and enacted Basel II restraining external financing from banks and in turn increased demand for capital from within the SC (Hofmann and Kotzab, 2010; Talonpoika et al., 2016). For this reason, importance of effective WCM increased dramatically, especially for SCs from emerging markets, that matter-of-factly faced difficulties with access to capital, limited financial infrastructure and legal, regulatory and accounting uncertainties in the first place (ACCA, 2014). Apart from that, the focus of the study on emerging markets is as well prompted by the fact that SCs stretch across the globe with a diverse range of suppliers in emerging markets, and it is failure of a supplier that can impact most severely the whole production process putting viability and continuity of a whole SC at threat. So, WCM is increasingly transcending boundaries of mature markets and has potential for economic stabilization, however most emerging market companies have not yet fully realized its benefits.

Likewise, coordinating mechanisms of WCM in SCs have received little attention due to the fact, that the role of financial coordinators (financial service providers, banks, FinTech companies and other financial intermediaries) as core participants in facilitating and enabling SCF has only recently been identified in academic literature (Silvestro and Lustrato, 2014). Along with that, the research is motivated by the call for more holistic approach to SCM on the grounds of merging financial and operational SC measures as existing literature either considers them separately or does not give insights on financial flows (Protopappa-Sieke and Seifert, 2010; Kroes and Manikas, 2014).

Authors address these gaps and develop coordinating WCM model aimed at minimizing total financial costs associated with each SC stage on the grounds of collaborative actions of SC players using SCF solutions (Reverse Factoring and Inventory Financing). The model is further verified on the grounds of the combination of mathematical modeling and case study of Russian distributive SC from ICT industry. The suggested model introduces holistic perspective to WCM and provides financial illustration for the motivation of SC partners to cooperate in order to simultaneously achieve target levels of working capital investments and improve individual financial performance and as a result strengthening whole SC competitiveness and value.

Methodology and model development

In compliance with the research aim of working capital optimization for all SC business partners and following the tradition (Talonpoika et al., 2014; Wuttke, Blome and Henke, 2013; Hoffman and Koztab, 2011; Randall and Farris, 2009; etc.), the core of the research methodology is based on quantitative methods. The research is based on the combination of mathematical modeling and case method. Mathematical modeling is suggested as a method to upgrade existing CCCC model (Hoffman and Kotzab, 2010) by optimizing it in terms of minimization of total financial costs associated with each SC stage.

The fundamental metric of WC is cash conversion cycle (CCC), which is a composite measure of “average interval between the time cash expenditures are made to purchase inventory for use in the production process and the time that funds are received from the sale of the finished product” (Schilling, 1996, p. 4-5). Farris and Hutchinson (2002) state this

definition to be "the most commonly accepted definition currently found in the literature". The CCC concept applicability was further extended from intra-organizational level of WCM to inter-organizational one by Hofmann and Kotzab (2010), who introduced collaborative CCC model (CCCC) as SC-oriented approach of WCM. CCCC is actually a sum of individual CCCs, but internal payments among the participants do not affect it and are not counted (Hofmann and Kotzab, 2010).

For the purposes of our research, we consider a simple three-stage SC consisting of a single supplier, distributor and retailer, what is actually a simplifying assumption. For this SC structure, we define collaborative cash conversion cycle (CCCC) as the sum of every CCC for all participants (1):

$$CCCC = \sum_{l=1}^{3} \sum_{k=1}^{K_l} CCC_l^k,$$
$$CCC_l^k = DIO_l^k + DRO_l^k - DPO_l^k, \quad (1)$$

where $l = \overline{1,\ 3}$ (1 – supplier stage, 2 – wholesaler stage, 3 – retailer stage),
$k = \overline{1,\ K_l}$, $K_l = \begin{cases} N, & l = 1, \\ 1, & l = 2, \\ M, & l = 3. \end{cases}$
$DIO_l^k -$ days of inventory outstanding for company k at stage l,
$DRO_l^k -$ days of accounts receivable outstanding for company k at stage l,
$DPO_l^k -$ days of accounts payable outstanding for company k at stage l.
Following this simple SC structure, we have constraints on CCCC elements (Eq. 2). The rationale behind these constraints is straightforward: it provides SC-oriented approach to CCC evaluation as duration of the internal payments among participants is excluded.

$$DRO_l^k = DPO_{l+1}^k, \quad (2)$$

where $l = \overline{1,\ 2}$, $k = \overline{1,\ K_l}$.

The total financial costs minimization is of common interest for all SC members; however, the rationale behind such collaboration is that each participant's financial costs are not worse than performing individually. We will evaluate financial costs associated with each SC stage with formula (3) introduced by Viskari et al. (2013):

$$FC_l^k\left(DIO_l^k, DRO_l^k, DPO_l^k, INV_l^k, AR_l^k, AP_l^k\right) =$$
$$= INV_l^k\left[\left(1 + c_l^k\right)^{\frac{DIO_l^k}{365}} - 1\right] + AR_l^k\left[\left(1 + c_l^k\right)^{\frac{DRO_l^k}{365}} - 1\right] - AP_l^k\left[\left(1 + c_l^k\right)^{\frac{DPO_l^k}{365}} - 1\right], \quad (3)$$

where $l = \overline{1,\ 3}$, $k = \overline{1,\ K_l}$,
c_l^k – annual cost of capital for company k at stage l,
$DIO_l^k, DRO_l^k, DPO_l^k$ – elements of CCC for company k at stage l,
INV_l^k – level of inventory at year-end for company k at stage l,
AR_l^k – level of accounts receivable at year-end for company k at stage l,
AP_l^k – level of accounts payable at year-end for company k at stage l.
Collaborative financial costs (CFC) function sums financial costs of all supply chain participants:

$$CFC = \sum_{l=1}^{3} \sum_{k=1}^{K_l} FC_l^k, \quad (4)$$

where $l = \overline{1,\ 3}$, $k = \overline{1,\ K_l}$.

We denote FC_l^{0k} as known beginning-of-the-year financial costs values (before optimization) for company k at stage l. Firstly, financial costs FC_l^k should not exceed values FC_l^{0k}, or:

$$FC_l^k \leq FC_l^{0k}, \quad (5)$$

where $l = \overline{1,\ 3}$, $k = \overline{1,\ K_l}$.

Secondly, we assume that each company in a chain has individual constraints on rate of inventory turnover:

$$DIO_l^k \geq DIO_l^{up}, \quad (6)$$

where $l = \overline{1,\ 3}$, $k = \overline{1,\ K_l}$,

DIO_l^{up} – target levels of days of inventory outstanding for company k at stage l.

Thirdly, following Garanina and Belova (2015) we denote CCC_l^k to confine to recommended industry specific stability interval providing favorable return-liquidity trade-off (Eq. 7). As such, we suppose a company is pursuing moderate approach to working capital management ensuring company's current ratio is higher than the industry average rate of return and at the same time, is below the value at which the relation between liquidity and rate of return becomes inverse (Garanina and Belova, 2015).

$$CCC_{low} \leq CCC_l^k \leq CCC^{up}, \quad (7)$$

where $l = \overline{1,\ 3}$, $k = \overline{1,\ K_l}$,

CCC_{low}, CCC^{up} – targeted lowest and highest levels of CCC for company k at stage l.

We incorporate the inward-looking approach to the problem of CCCC optimization (Hofmann and Kotzab, 2010), so for optimization we only use elements of CCCC that are immediately within the specified perimeter of a SC. As such, values of DPO_1^k and DRO_3^k after optimization should equal their values before optimization:

$$DPO_1^k = DPO_1^{0k},\ k = \overline{1,\ N},$$
$$DRO_3^k = DRO_3^{0k},\ k = \overline{1,\ M}. \quad (8)$$

Furthermore, we suppose elements of CCCC (1) to be nonnegative and continuous:

$$DIO_l^k, DRO_l^k, DPO_l^k \geq 0, \quad (9)$$

where $l = \overline{1,\ 3}$, $k = \overline{1,\ K_l}$.

Finally, we construct the optimization model as follows: to minimize CFC (4) under constraints (2), (5) – (9). The objective function and constraints are separable functions. As such, for this nonlinear separable programming problem we employ gradient general nonlinear algorithm (Stefanov, 2013).

The theoretical model is further tested on the grounds of case study of collaborative SC from ICT industry, that is generally characterized by an integrated business environment and fast technology development. It is service-oriented, and has a large variety of end products and

customers. Besides, even though individual companies in the ICT industry have been used in many case studies, and the SCs of single products or companies have been examined, the ICT networks at the industry level have been studied relatively little (Lind et al., 2012; Pirttilä et al., 2014). The focal company in a chain is a Russian public telecommunication services provider, holding licenses for local, long-distance and mobile telephone services, data, TV and value-added solutions to residential, corporate and governmental subscribers and third party operators. The company operates across all regions of the Russian Federation, Europe and Asia.

The data concerning the supply chain business partners was retrieved from semi-structured interviews with middle-level operations managers, that was further triangulated with secondary data sources (annual financial reports downloaded from Thomson Reuters Eikon).

Findings

In this section, we present our findings by illustrative numerical example. The choice of a numerical analysis of SC operating in information and communication technology (ICT) industry is motivated by the fact that it is characterized by a highly integrated business environment and fast technology development (Pirttilä et al., 2014). It is service-oriented, and has a large variety of end products and customers. Besides, even though individual companies in the ICT industry have been used in many case studies, and the SCs of single products have been examined, the ICT chains at the industry level have been rarely studied (Lind et al., 2012). For simplicity, we consider a chain consisting of a single supplier, wholesaler and retailer.

The model parameters we consider are based on data (Tab. 1) retrieved from the Wholesaler's Annual Report and interviews with Supplier's and Retailer's financial managers.

Table 1. Year-beginning data (before optimization)

l	***Supplier***	***Wholesaler***	***Retailer***	***Total (SC)***
INV_l^0	1,342.0	11,593.0	972.0	13,907.0
AR_l^0	1,374.0	816.2	119.0	2,309.2
AP_l^0	901.0	2,896.2	85.0	3,882.2
WC_l^0	***1,815.0***	***9,513.0***	***1,006.0***	***12,334.0***
$COGS_l^0$	6,345.0	22,981.0	5,528.0	X
$Revenue_l^0$	7,419.0	29,792.0	6,588.0	X
c_l	0.0818	0.0474	0.0338	X
DIO_l^0	77.2	184.1	64.2	X
DRO_l^0	67.6	10.0	6.6	X
DPO_l^0	51.8	46.0	5.6	X
CCC_l^0	***93.0***	***148.1***	***65.2***	***306.3***
FC_l^0	***32.5***	***258.1***	***5.7***	***296.3***

The results in Table 2 contain elements of CCC and financial costs FC for all supply chain business-partners at the end of the planning period as well as the relative change in CCCC model elements after optimization.

Table 2. Results of CCCC modeling (year-end, after optimization)

l	*Supplier*		*Wholesaler*		*Retailer*		*Total (SC)*	
INV_l^0	132.4	-90.13%	12,802.6	10.43%	972.0	0.00%	13,907.0	0.00%
AR_l^0	1,989.6	44.80%	578.6	-29.11%	119.0	0.00%	2,687.3	16.37%
AP_l^0	901.0	0.00%	6,163.0	112.80%	107.4	26.35%	7,171.4	84.73%
WC_l^0	*1,221.0*	-32.73%	*7,218.2*	-24.12%	*983.6*	-2.23%	*9,422.9*	-23.60%
DIO_l^0	7.6	-90.16%	203.3	10.43%	64.2	0.00%	X	X
DRO_l^0	97.9	44.82%	7.1	-29.00%	6.6	0.00%	X	X
DPO_l^0	51.8	0.00%	97.9	112.83%	7.1	26.79%	X	X
CCC_l^0	*53.7*	-42.26%	*112.5*	-24.04%	*63.7*	-2.30%	*229.9*	-24.94%
FC_l^0	*32.5*	0.00%	*258.1*	0.00%	*5.7*	0.00%	*296.3*	0.00%

The illustrative example results depict the decrease in CCCC by 24.94% without further financial costs. The acceleration in the cash conversion cycle is mainly a consequence of CCC decrease for the Supplier and the Wholesaler (- 42.26% and -24.04% respectively, Table 2).

The CCCC boost is achieved based on decreasing days of inventories for the Supplier (-90.16%, from 77.2 days to 7.6 days) and reallocation of a major part of inventories to the Wholesaler. Moreover, the Supplier faces increased DRO (by 44.82%, from 67.6 days to 97.9 days). This target is achievable due to ICT industry specifics: ICT suppliers often render only services, and thus they do not need high levels of inventories, but have a long DRO instead. The long DRO in turn can be explained by the fact that ICT suppliers in most cases give their customers time to test the new system before the customer has to pay the final installment. The Wholesaler's optimal behavior is granted with DRO declining (-29.00%, from 10.0 days to 7.1 days) as well as 112.83% (from 46.0 days to 97.9) increase in DPO. This may signal that the Wholesaler is in a position to provide financing to other SC participants using various forms of SC financing solutions (approved payables finance, advanced inventory financing, trade-credit, factoring, reverse factoring, and supplier subsidy) alleviating their high working capital requirements. Ii is as well prompted by the fact that most financial service providers focus on large, international companies and generally lack the established means to approach small and medium-sized enterprises and their alternative financing needs. In contrast, financing 80-100 percent of their receivables or payables from an experienced partner involved in a collaborative supply chain can be achieved at a very low cost. The Retailer in its turn achieves a significant increase in DPO (26.79%, from 5.6 to 7.1 days) that gives him the opportunity to reinvest his working capital or at least decrease his requirements by 2.23%. From the SC perspective this definitely fits the customers' side objectives for the financial flows as does not imply acceleration of payments. Moreover, extended payment terms can increase customer satisfaction.

Discussion and conclusions

The main goal of this paper was to develop a model of working capital optimization in collaborative supply chains and to describe how companies can benefit from collaboratively managing their financial flows at the supply chain level. The study indicates that companies do not yet use of available opportunities adequately. By identifying possible ways of implementing CCCC optimization, the research illustrates approaches for companies to overcome existing challenges. The research contributes to existing SCM literature by focusing

on financial flows and studying its optimization. The research integrates financial and supply chain perspectives on the involvement of WCM on the supply chain level.

Managerial actions towards working capital in collaborative supply chains are critical at the operational level for such operations as supply chain management, production, procurement and finance. The companies have gained knowledge how to assess the cycle time of working capital at the intra-organizational level, but estimation of this at the inter-organizational level still causes difficulties for the companies involved in collaborative supply chains. This paper provides insights into collaborative evaluation of CCC using an optimization CCCC model by accurately assessing the length of the cycle time of working capital and the total financial costs associated with it.

There are two main theoretical implications of the paper that correspond to the main objectives justified by the empirical study. Current studies outline the importance of working capital management in supply chains because companies need to adjust their operations to the volatile economic and financial environment. Firstly, the gap in research that connects the CCC approach and the three-stage collaborative supply chains is filled by the development of the CCCC concept. Secondly, the authors contributed to an improvement in the methodology of working capital assessment in collaborative supply chains by introducing the optimization CCCC model that provides a holistic view to the collaborative supply chains. The developed methodology is suitable for a threestage collaborative supply chain and is applicable for usage for business, consultancy, 3PL or bank as an intermediary or the decision maker.

Future research should seek to extend the context of this paper by investigating the possible imputation options for gained costs reduction on the grounds of cooperative games with coalition structure as there is power asymmetry among players leading to possible lack of motivation to cooperate in the process of collaborative working capital management.

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IKEA: Global sourcing and sustainable leather initiatives

Summary
Aims: The aim of this teaching case is to illustrate the Sustainable Global Sourcing (SGS) practices of IKEA influenced by its Global Sourcing (GS) strategy and structure aspects through a case study of the sustainable leather initiative.
Scope: This study is developed though 20 face-to-face interviews with IKEA managers in both Sweden and China, covering all the major SGS-related departments i.e. purchasing, sustainability, IWAY, and competence center (sustainable project team).
Contribution: We provide a benchmark of SGS for other multinational companies and allows for a thorough discussion of a sustainability initiative in a GS context. The case can be used to teach graduate/postgraduate in agricultural economics, MBA and executive students on sustainable supply chain management and corporate social responsibility.
Keywords
Global sourcing strategy; global sourcing structure; sustainable leather initiatives; teaching case
Submission category: educational paper

Introduction

In a sunny afternoon, Peter Agnefjäll, the President and CEO of IKEA Group and the Group Management team members sat in the meeting room, summing up the results of the past year and discussing the following reorganization issues that Group is facing in the next.
IKEA Group is a leading retailing company and has been engaged in sustainability for many years. In nowadays business environment, MNCs sourcing globally face pressures from consumers and Non-Governmental Organizations (NGOs) of not addressing environmental and social concerns sufficiently. IKEA constantly performs well in integrating social and environmental sustainability into its Global Sourcing (GS) activities.
Peter Agnefjäll concluded that FY16 was a remarkable year for them in many ways. The sales grew to EUR 34.2 billion. Together with the rental income from the shopping centre business (IKEA Centres), total revenue increased by 7.4% to EUR 35.1 billion. Meanwhile, On 31 August 2016 they sold their product development, supply chain and production companies to Inter IKEA Group. Together, they also created a movement, meeting and bringing people together around food in new ways. And they made the food served and sold in their stores more healthy and sustainable. Peter Agnefjäll highly affirmed the past achievements and proposed the questions run through his mind.
He indicated that, in next the Group plans to implement a sustainable initiative for the leather supply chain, and it requires the transformation of their organizational structure to better fit its sustainable global sourcing (SGS) strategy. However, implementing such an initiative is complicated due to the various factors involved, such as long distances of transportation, overseas suppliers, resources investment and cultural differences, among others. To carry out this initiative, Peter Agnefjäll proposed the following questions emerged for Group Management team to consider. IKEA aims to restructure the way of GS by category, so what appropriate GS strategy and structure is needed in order to enable the sustainable initiative e.g. sustainable leather initative? How do GS strategy and structure shape a sustainable leather initiative? What processes could IKEA use to implement a sustainable leather initiative?
These questions bother the Group Management team members, especially for the lead of Purchasing Group and Sustainability Group at IKEA Sweden. They wonder how to deal with these problems and work together to implement the sustainable initiative. To answer these questions, we first provide IKEA's overall background followed by a detailed explanation of

IKEA's GS strategy and structure. Then, the leather initiative is elaborated in light of the GS strategy and structure. In this teaching case, we explore SGS influenced by IKEA's GS strategy and structure through its sustainable initiatives on leather supply chain.

Company and organization background

IKEA is a multinational group, headquartered in the Netherlands, designs and sells ready-to-assemble furniture, kitchen appliances and home accessories. IKEA received €11 billion in sales revenue and more than 1.1 billion euros in net profit, becoming the world's largest furniture retailer in 2003. Founded in Sweden in 1943 by the then 17-year-old Ingvar Kamprad, the company's name is an acronym that consists of the initials of Ingvar Kamprad, Elmtaryd (the farm where he grew up), and Agunnaryd (his hometown in Småland, southern Sweden). The company is known for its modernist designs for various types of appliances and furniture, and its interior design work is often associated with an eco-friendly simplicity. In addition, the firm is also known for its attention to cost control, operational details, and continuous product development. These corporate attributes have allowed IKEA to lower its prices by an average of 2-3% over the decades to 2010 during a period of global expansion. All of these are well summarized in its business strategy, i.e. "to offer a wide range of well-designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them" (IKEA website).

The groups of companies that form IKEA are all controlled by INGKA Holding B.V., a Dutch corporation, which in turn is controlled by a tax-exempt, not-for-profit Dutch foundation. The IKEA trademark and concept is controlled by a series of corporations that can be traced to the Netherlands Antilles and to the Interogo Foundation in Liechtenstein. INGKA Holding B.V. owns the industrial group Swedwood, which sources the manufacturing of IKEA furniture, the sales companies that run IKEA stores, as well as Purchasing and Supply functions, and IKEA of Sweden, which is responsible for the design and development of products in the IKEA range. INGKA Holding B.V. is wholly owned by the Stichting INGKA Foundation, which is a non-profit foundation registered in Delft, Netherlands. The European logistics centre is located in Dortmund, Germany, and the Asian logistics centre is located in Singapore. Inter IKEA Systems B.V. in Delft, owns the IKEA concept and trademark, and there is a franchising agreement with every IKEA store in the world. The INGKA Group (not to be confused with INGKA Holding B.V.) is the biggest franchisee of Inter IKEA Systems B.V., the latter not being owned by INGKA Holding B.V., but by Inter IKEA Holding S.A. registered in Luxembourg, which in turn is controlled by the Interogo Foundation in Liechtenstein. Ingvar Kamprad has confirmed that he and his family control this foundation. The company, which originated in Småland, Sweden, distributes its products through its retail outlets.

As of December 2016, IKEA owns and operates 392 stores in 48 countries, 22 pick-up and order points in 11 countries, 41 shopping centres in 15 countries and 38 distribution sites in 18 countries. In FY16 (financial year 2016, from September 2015 to August 2016), IKEA had 783 million store visits and 425 million shopping centre visits, and sold €34.2 billion worth of goods, representing a 7.1% increase over FY15. Meanwhile, the IKEA website contains about 12,000 products and is the closest representation of the entire IKEA range. There were over 2.1 billion visitors to its websites and €1.4 billion online sales across 14 IKEA Group markets in FY16, an increase of 9% compared to FY15 (IKEA Group Sustainability Report FY16).

IKEA has a long tradition of embedding sustainability in its operations. The company is keen to show leadership in integrating sustainability across its business. As Steve Howard, the Chief Sustainability Officer of IKEA Group said in his TEDTalk (talk videos from expert speakers on education, business, science, tech and creativity),

"Sustainability has gone from a nice-to-do to a must-do. It's about what we do right here, right now, and for the rest of our working lives…. If you're a business leader, if you're not already weaving sustainability right into the heart of your business model, I'd urge you to do so."

The vision of IKEA is to create a better everyday life for many people and it adopts a People & Planet Positive strategy to work towards this vision. The strategy focuses on three aspects: inspiring and enabling millions of customers to live a more sustainable life at home; striving for resource and energy independence; and taking a lead in creating a better life for the people and communities influenced by its business. IKEA sets minimum requirements on environment, social and working conditions throughout its supply chain, i.e. IWAY (the IKEA way on purchasing products, materials and service). IWAY is the IKEA supplier code of conduct, which ensures a mutual understanding on sustainability with its suppliers. IKEA transferred the responsibility to IWAY to visit suppliers and monitor their compliance with the code of conduct. IKEA has been adopting IWAY since 1999 to ensure that products are made to an environmentally and socially acceptable standard. Furthermore, IKEA pays particular attention to vulnerable groups in its supply chain, such as migrant workers and home-based workers, to ensure that they can access decent employment including wages, working conditions and labour rights (IKEA Group Sustainability Report FY16).

IKEA global sourcing strategy and structure

IKEA global sourcing strategy

GS within IKEA has always been an important contributor to realizing the Vision and Business Idea. IKEA comes from a trading organization that delivers excellent results based on internal competition and a strong focus on manufacturing in low cost countries. This has generated cost savings when moving volumes from Western Europe to Eastern Europe and Asia. However, this way of working has also left room for improvements related to better cooperation and increased transparency within IKEA.

To take full advantage of the economies of scale and competence, IKEA decided to develop its GS strategies based on categories (product lines). This led to the product-based strategy and a common agenda towards suppliers. The product-based strategy contributed to the Supplier Development Process and a clear way of working with suppliers. With the Supplier Development Process, IKEA now has a more concentrated supplier base, reducing the number of suppliers from 2,000 to 1,000 in FY16. Meanwhile, IKEA has set a common agenda with suppliers and works together with them under a common agenda. In this way, IKEA optimizes the whole value chain and obtains good products at low cost. Regarding consistent excellent performance, IKEA will continue its GS works with a product-based strategy and its way of developing suppliers.

IKEA's GS strategy is characterized by Three Cornerstones, i.e. lower total cost from material to customer, IKEA supplier – partners for growth, and one IKEA purchasing – simple and professional.

Lower total cost from material to customer

By working together to optimize the whole value chain, IKEA makes better products and provides services at a lower total cost. The total cost approach empowers the IKEA organization to make decisions closer to reality. IKEA strives to connect suppliers to customers' needs and expectations. Optimizing the whole value chain from material to customer is only possible by integrating the internal functions and external stakeholders, from an end-to-end perspective. It starts with the design of the product, from the choice and use of sustainable materials and techniques, to design for efficient manufacturing (cost and quality), logistics, the buying process and customer use. By using standard solutions, components and platforms, IKEA develops its offering at a faster speed as well as a lower cost.

IKEA shares its business model with suppliers, and purchasing volume is the foundation for this. The large purchasing volume helps IKEA obtain a high bargaining power and save costs. Meanwhile, it can further ensure IKEA is involved in some suppliers' choices, such as buying machinery and developing technologies. Furthermore, the large purchasing volume also makes it possible to invest in more efficient industrial production set-ups and to drive industrialization of new industries, which leads to better quality and lower cost. IKEA develops material and components strategies by focusing on affordability, accessibility and sustainability.

IKEA suppliers – partners for growth

To offer better products that are affordable for the many and to develop a more successful IKEA, a diverse and concentrated supplier base is required to meet the needs of businesses and customers. Partnerships are built on a shared business model and values, which IKEA calls strategic fit.

IKEA has developed a diverse but concentrated supplier base, which can handle more products and service with a higher flexibility as well as a faster reaction speed. It reacts to customers' needs with speed and accuracy. The IKEA supplier base is also concentrated. It has a smaller number of suppliers and an integrated way of working, which contributes to the development of products, standard solutions, components and platforms.

IKEA positions itself as a preferred business partner, both for existing suppliers and new potential suppliers. IKEA's partnership is characterized by mutual respect, trust and transparency. Based on shared business plans and common goals, IKEA creates the conditions for suppliers to be able to take full responsibility for performance. The allocation of responsibility to suppliers helps IKEA move its focus from controlling to business development, and in this way, suppliers are more proactive in following IKEA's plans and goals.

One IKEA purchasing – simple and professional

IKEA develops GS strategies for categories and action plans with suppliers using the Purchasing Development and Supplier Development processes. The work is based on and contributes to IKEA's leadership. IKEA develops a business intelligence platform and has a common framework for defining, communicating and mitigating risks, leading to one view on trade barriers, market, political and sustainability risks as well as volatility in currency and raw materials. To deliver results IKEA takes the required measures to implement its strategies and action plans, by organizing the key initiatives as projects (e.g. cotton project and leather project).

To enable professional GS, IKEA has a simple and efficient organization, with a shorter distance between customers and suppliers, and fewer people involved. This leads to an agile and empowered organization, where IKEA takes leadership and gives clarity about where and by whom decisions are made and who is accountable. The principle is that IKEA acts as One IKEA Purchasing for the core processes, with all functions and people contributing directly towards the business objectives. The business needs set the agenda for the allocation of resources, regardless of function or location.

IKEA global sourcing structure

IKEA has three processes: product range (product development), supply (including purchasing and logistics) and sales (retailer). Transportation has been outsourced but warehousing is operated in-house. IKEA implements GS with Range & Supply organizations and a total of 6,800 co-workers around the world. IKEA Range & Supply consists of two units: IKEA of Sweden AB (range) and IKEA Supply AG (supply).

IKEA Range & Supply

IKEA Range is the organizational structure for product development and innovation. IKEA of Sweden AB is structured into 10 Business Areas, i.e. Livingroom & Workspace; Bedroom &

Bathroom; Kitchen & Dinning; Children's IKEA; Lighting & Home Smart; Textiles; Cooking, Eating & Decoration; Outdoor, Storage, Organization & IKEA Family; Free Range; and IKEA Food. IKEA Range is the core of the IKEA business. It is developed to inspire people and provide solutions to everyday home furnishing needs. Each year, IKEA introduces approximately 2,000 new products to the IKEA stores. The complete IKEA range consists of almost 10,000 products.

IKEA Supply AG is the main wholesale company. It owns the goods in the distribution centres and is responsible for cross-border flows and replenishment, and goods to various IKEA Retail Companies (and to local wholesale companies in Russia and China). The way IKEA works within its supply chain has always been an important contributor to realizing the IKEA vision and business idea. By taking an interest in efficient production and constantly working to lower logistics costs, IKEA strives to be the strong link between suppliers and customers. The goal of the IKEA Purchasing & Logistics organization is to take the lead in optimizing the total value chain, contributing to the goal of providing better products at lower prices.

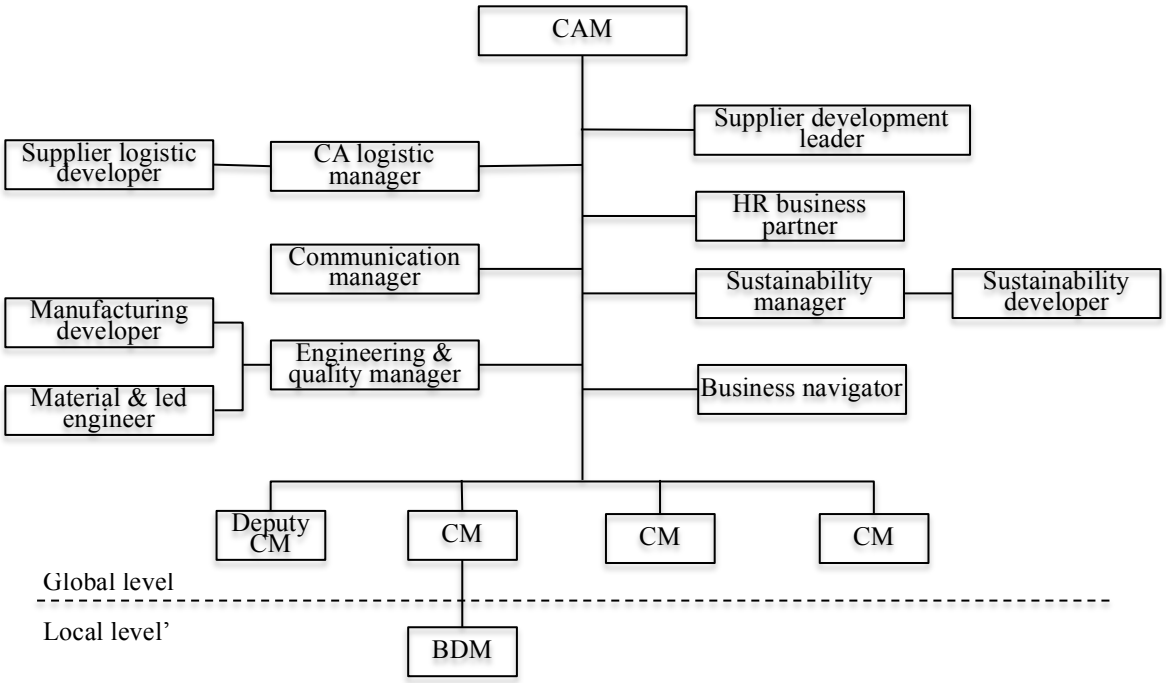
IKEA Purchasing development is divided into seven category areas (CAs): 1) Flatline, 2) Wood & Fibres, 3) Comfort, 4) Textiles, 5) Electronics, 6) Metal, Plastic and Float Glass, and 7) Specific Home Furnishing Business (stearin, tableware, green plants, etc.). Logistics in the Inter IKEA Group includes Global Distribution Network Design, Global Goods Flow and Capacity Planning, Global and Regional Transport Purchasing and Operations, Regional Supply Teams (Europe, Asia Pacific, and North America), Regional Quality Support Centres, and Customs Service Centres.

IKEA purchasing development and logistics works are organized geographically as Purchasing and Logistics Areas (PLAs), of which the predecessor was trading areas. PLAs are internal trading companies but are centrally funded. There are 9 PLAs with 24 offices in IKEA, i.e., South Europe, South East Europe, North Europe, North East Europe, Central Europe, Americas, South Asia, South East Asia and East Asia. China belongs to the East Asian PLA and has 4 offices i.e. Qingdao, Shanghai, Shenzhen and Taipei. Suppliers are selected based on their competitiveness, including price, capacity, innovation capabilities and sustainable performance.

Centralized GS planning

IKEA GS work is centrally planned and organized by category area. There are four GS levels with each level contributing in different ways. According to Echo Ye, the Deputy Category Manager at the Shenzhen IKEA trading office,

> *"When planning GS, the first level is 7 category area managers (CAMs) in global, who are responsible for the 7 CAs respectively and directly lead the work of category managers (CMs); the second level consists of CMs also located in global, who are in charge of drawing up the 5 years GS strategic plan; the third level is made up of CMs and business developing managers (BDMs), who are working together to make the 2-3 years tactical plan according to the 5 years GS strategy; the fourth level is BDMs in local, who take charge of working out the 1-2 years operational plan according to the 2-3 years GS tactics, and directly lead the business team (BT) which is organized for interface with suppliers in local."* Shown in Figure 1.



(Source: summaries from interviews by authors)

CAM: category area manager
CA: category area
CM: category manager
BDM: business developing manager

Fig. 1 IKEA GS structure

From global to local level, GS activity is structured as a BT. Daniel Xu, the Business Developer at the Qingdao IKEA trading office claims that one BT usually consists of three staff: business developer, supplier planner and production engineer. Sometimes there is also a product engineer, who supports more than one BT at a time. Usually a BT is established according to the GS products.

Matrix management and support functions

IKEA GS is centrally planned with matrix management. IKEA Range & Supply also consists of several matrices and a number of support units. One example is the IKEA Sustainability Management Group. The Chief Sustainability Officer (CSO), Steve Howard, is a member of Group Management and reports directly to Peter Agnefjäll. The CSO chairs the Sustainability Management Group, which brings together sustainability managers from the main business areas. Together they review performance against the targets and make strategic decisions on sustainability in the IKEA Group. Progress towards the goal is reported to Group Management and the Supervisory Board every three months. In FY16 the Sustainability Management Group comprised the Heads of Sustainability Policy & Compliance, Sustainability Innovation, Sustainability Communication, and sustainability managers from Range & Supply, IKEA Industry and Retail & Expansion. From September 2016, the Sustainability Management Group comprises the IKEA Group Chief Sustainability Officer, the Heads of Sustainability Integration & Development, Sustainability Policy & Compliance, Sustainability Innovation and Sustainability Communication, and sustainability managers from IKEA Centres, IKEA IMS, Customer Fulfilment and IKEA Property.

In addition, there are several other functions/units and legal companies operating in IKEA Range & Supply, such as IKEA Components, Regional Supply teams, Logistics Development, Sales & Supply planning, Transport, Purchasing operations, Quality Support Centres, IKEA communications AB, and Product Development Centre (China).

IKEA sustainable global sourcing

IKEA responsible sourcing

IKEA's sustainability agenda is integrated into its GS strategy across both governance and business aspects. The People & Planet Positive strategy makes the company groups work closely together to ensure the sustainability efforts across the whole value chain. IKEA's goal is for SGS to have a positive impact on people and the planet. Stefan Karlsson, the Sustainability Compliance Manager at IKEA Purchasing Service (China) Co., Ltd., said:

> *"The long-term is being close to the market where we are to source more environmentally friendly products. We consider five dimensions of our democratic design, form, functionality, quality, sustainability and low price. Of course, the price is very important. The sustainability aspect is regarding what kind of materials do we use, what kind of processes do we have in our production, to become more sustainable. We identify critical materials, because they can be recycled in the supply chain, cotton is one of them, leather is another one. It's not only about the sustainability in terms of environment, but also about people in our supply chain, like the working conditions."*

IKEA implements responsible sourcing by going beyond the supply chain to ensure sustainable resource management across the industry. Sustainable resource management is protecting the raw materials that go into IKEA products and ensuring a sustainable supply chain (SSC), which is vital for the long-term viability of the business. The raw materials include wood, cotton, palm oil and leather By June 2015, the IKEA Foundation has implemented programmes to promote children's rights, fight child labour and create opportunities for families living in the cotton supply chain communities in India and Pakistan, and leather supply chain communities in Brazil.

By August 2015, 100% cotton used in IKEA products is sourced from sustainable sources, and IKEA continuously investigates complementary fibres with improved sustainability performance compared to cotton. By December 2015, 96% palm oil (Candles 100%, food approximately 50%) currently used in home furnishing products comes from certified segregated sustainable sources or is substituted with more sustainable alternatives. By August 2016, 61% of wood comes from sustainable sources. By August 2020, IKEA aims to source 100% of its wood, paper and cardboard from more sustainable sources.

By August 2015, 100% of the leather IKEA sourced is chromium-free, and from September 2015 onwards all IKEA's leather is produced using 'wet-white' tanning or other alternatives to chromium, which is highly polluting. By August 2016, IKEA has achieved traceability of cattle leather and hides back to slaughterhouses. By August 2017, IKEA has secured traceability of all leather back to slaughterhouse level and has developed and started to implement requirements to secure social and animal welfare issues. Next, the sustainable leather initiative is used to illustrate the SGS practice influenced by IKEA's GS strategy and GS structure.

Motives for IKEA responsible sourcing

IKEA has been committed to sustainability for many years. According to Peter Agnefjäll,

> *"Urgent action is needed to tackle climate change – communities across the world and the success of business depend on it. That's why IKEA Group is going all-in to be part of the solution. We see action on climate change as a driver of innovation, investment and renewal."*

IKEA Group welcomes Sustainable Development Goals (SDGs) as a catalyst towards achieving a more sustainable and equal world. It will use the goals to guide and inspire itself in developing a sustainability agenda. IKEA has mapped its People & Planet Positive strategy against the goals, and identified seven in particular, where it can make the greatest contribution. The seven goals for excellent achievements are: *gender quality*, *affordable and clean energy*, *decent work and economic growth*, *reduced inequalities*, *responsible*

consumption and production, *climate action*, and *life and land*. Responsible sourcing is the main strategy regarding the *life and land* goal. Following this strategy, IKEA sources its key raw materials, such as cotton, wood and leather, from more sustainable sources.
Meanwhile, to find the most competitive supply market and suppliers, IKEA also considers a list of factors including total cost, quality, availability, sustainability and preferred partner. According to Stefan Karlsson,

> *"IKEA is a big global company and we have stores almost around the world. Global sourcing is of course important and I think the sustainability agenda actually emphasises that, knowing where we need to have suppliers because some products are very bulky, being too far away, not only for the cost perspective or killing the products' speed, it's not going to be competitive to deliver to stores all over the world. So one direction is of course from the costs perspective. The second that we are also very much looking into is sources from the environmental perspective, for example, if you deliver or transport products over long distances, it will cause additional CO_2 emissions, so it's also in our way of thinking when setting up new suppliers."*

In particular, as China is the largest single supply market with a 26% share of the supply (IKEA Group Sustainability Report FY16), the motive to open the Greater China trading area includes not only the reasons stated above but also to collect supply market intelligence.

IKEA sustainable leather initiatives

IKEA leather profile

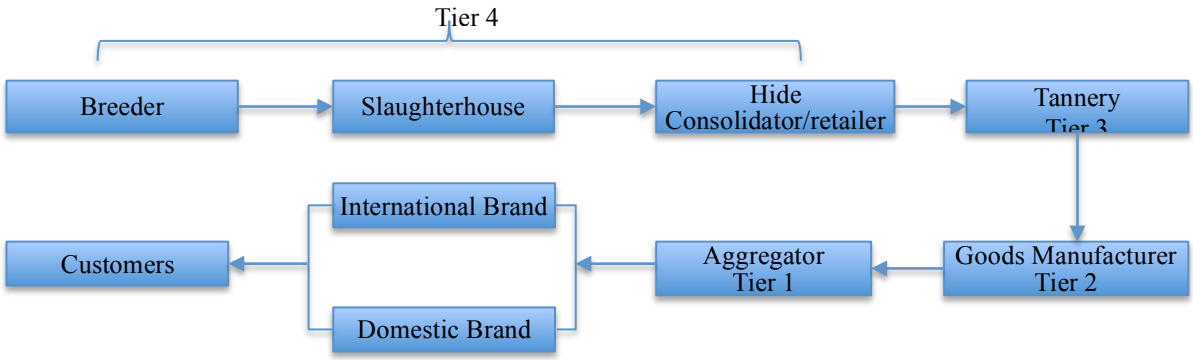
Every year IKEA uses about 3 million m^2 of leather in its home furnishing products, including sofas and rugs. This comes from eight leather suppliers and three hair-on-leather suppliers. Brazil supplies around half of the leather and sheepskin IKEA uses annually. However, at present, the retailers from major business districts and international brands are facing the requirements of knowing the product sources and production conditions requested by consumers and NGOs, so retailers and brands need to ensure that the sources of leather are legal and in line with the Convention on International Trade in Endangered Species of Wild Flora and Fauna. In recent years, the leather industry has been questioned by human rights organizations, environmental organizations and animal protection organizations, as they believe that the leather industry is in violation of the relevant laws in aspects of work conditions, environmental controls and animal welfare. In response to these statements and to prove that the leather supply chain is open and transparent, more and more brands and retailers are trying to introduce a traceability system for the leather supply chain. In the era of globalization, traceability of the leather supply chain industry has become increasingly complicated. Throughout the whole process from the transaction of raw hides to leather production and sales, mixed participants from different parties around the world are involved. The leather making process also uses many physical-chemical processes, which makes monitoring each hide or skin a challenge (ITM, 2017).
In respect to this, IKEA works closely with its partners to address the environmental and social issues that are common in leather supply chains, such as forced labour, chemical pollution and cruelty to animals. For example, IKEA has been working with suppliers and a number of chemical companies to find ways to reduce chemical use, and the carbon and water impacts of the tanning process. IKEA has met the chromium-free leather target, now the company is focusing on continuing to improve leather traceability. IKEA sets minimum social, environmental and animal welfare standards for its direct suppliers, including a requirement that leather does not come from suppliers linked with deforestation in the Amazon. IKEA's goal is to ensure animal welfare in its supply chain – whether animals are treated humanely, and with the opportunity to express natural behaviours. Over the past year IKEA has developed the IKEA Farm Animal Welfare position to drive progress on animal welfare for

all animals in its supply chains. IKEA commits to protecting animals' health, physiological and behavioural needs. This is important for animal-derived raw materials used as food ingredients, or in its home furnishing range, such as leather. It applies at all stages of an animal's life, and within all tiers of its supply chain.

IKEA leather supply chains

Generic leather supply chains

The key supply chain entities in the leather sector can be divided into four tiers or levels: tier 1 consists of exporters or retailers; tier 2 is the finished product manufacturers; tier 3 is tanneries and tier 4 is raw hide suppliers including breeders, slaughterhouses and hide consolidators/retailers. The leather industry value chain is shown in Figure 2.



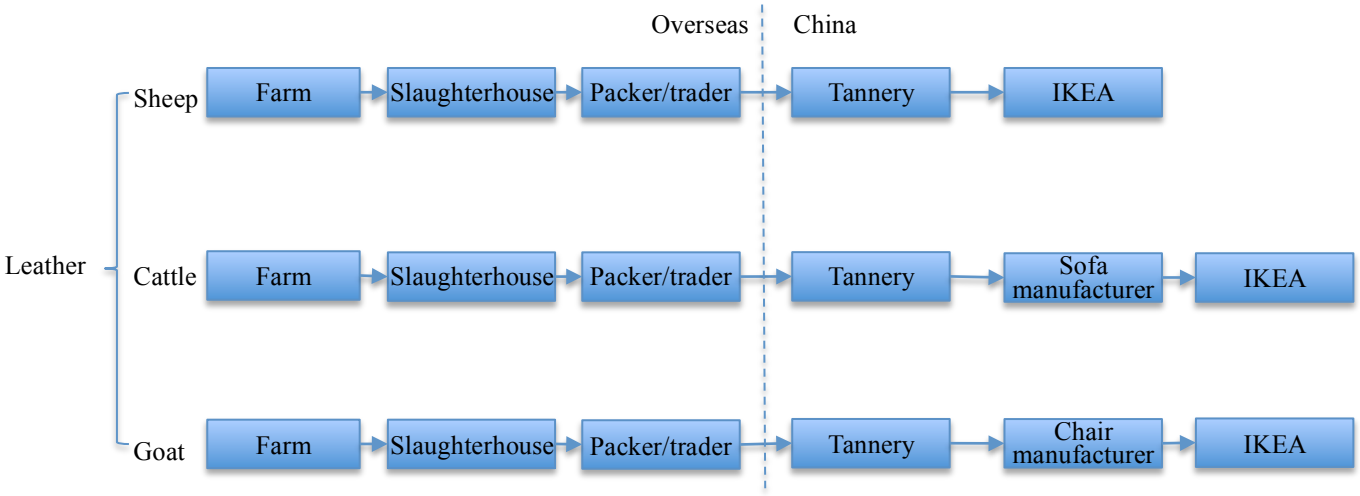
(Source: KPMG, 2013)

Fig. 2 The leather industry value chain

The leather supply chain entities listed above are summarized from the general situation of the leather industry. Thus, there may also be various combinations in which product flow happens between the different tiers and all steps may not necessarily be followed. In some cases, tiers 1 and 2 operations may be conducted by a single organization (KPMG, 2013).

IKEA's leather supply chains

IKEA's leather supply chain includes cattle farms, slaughterhouses, tanneries and finishers. According to Frank Ouyang, the Leather Competence Center Manager (LCCM) from IKEA China, the IKEA Leather Competence Center (LCC) in China is responsible for sourcing three kinds of leather globally, i.e. cattle, sheep and goat. The reason for GS is the lack of resources in the China market. Due to the Chinese meat consumption habits, there are many pig breeders in China, so the large volume of raw hides are pigskins and the volume of cattle skins and sheepskins are very small. Thus, for the tanneries located in China even in Asia, cattle skins and sheepskins are almost all imported. IKEA has three leather supply chains corresponding to the three kinds of leather, as shown in Figure 3. Leather from cattle is purchased mainly from South America, North America, Europe and a little from Africa, the major GS countries include America, Brazil, Germany, the United Kingdom, Australia and France; leather from sheep is sourced from Australia and New Zealand, a little from Britain and Argentina; and leather from goat is procured mainly from Australia.



(Source: summaries by author)

Fig. 3 IKEA's three leather supply chains

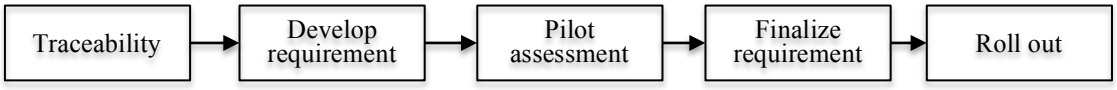
According to Frank Ouyang, IKEA's three types of leather supply chain begin at farms, which may include several different kinds of farms. For example, a beef cattle farm keeps the cattle newborns with their mothers until weaning; then a cow-calf farm buys the calf from the beef cattle farm and continues to raise the calves until they are young beef cattle; after that, the young beef cattle are usually sold to a feedlot to be raised for meat. All these kinds of farms are seen as one tier in the leather supply chain, and finally the cattle are sold from the feedlots to slaughterhouses. It is also possible that there is no feedlot, and the cattle are sold directly from a cow-calf farm to slaughterhouses. This depends on customer demands, such as cattle breeds, ages, grades, etc.

After the slaughterhouse, there are various packers and traders involved before the tanneries. The packers, who are mainly responsible for sorting and salting the leather, sort the leather first according to several criteria, such as size, quality, scar area, etc. Meanwhile, the leather also needs to be salted to avoid rotting. After sorting and salting, the leather is distributed by traders to tanneries, which are local suppliers in the example of China.

After the tanneries, there are three paths of supply: leather from sheep is sold direct to IKEA stores; leather from cattle is sold to sofa manufacturers and then to IKEA stores; and leather from goat is sold to chair manufacturers and then to IKEA stores. The reason for this is that there are two kinds of leather usage in IKEA. One is called Carpet leather (i.e. leather from sheep), which is sold direct to IKEA stores after being bought from the tannery. The other kind is Upholstery leather (i.e. leather from cattle and goat), which needs to be finished for sofas and chairs after being bought from the tannery. In this case, the tier 1 supplier for IKEA is sofa manufacturer and chair manufacturer.

Five steps of the sustainable leather initiative process

The leather supply chain is complex and IKEA conducts sustainable initiatives for each part throughout the whole chain. According to Frank Ouyang, IKEA has already traced down to the slaughterhouse level, and continues to work towards having traceability to the farm level. Furthermore, IKEA has also developed a requirement for leather traceability, and within 2017 – up to August 2017, IKEA aims to test this requirement in the leather supply chain. That means IKEA goes out to suppliers to check if the requirement works and whether IKEA has the right requirement set. By the end of 2017, all of the leather IKEA uses will be fully traceable and produced according to standards that help protect forests and respect animal welfare. For IKEA, good animal welfare means that all animals in its supply chain live a life worth living, which is achieved through the protection and promotion of good health, physiological and behavioural needs. IKEA endeavours to uphold the Five Freedoms, i.e. that all animals in its leather supply chain have freedom from thirst or hunger, freedom from discomfort, freedom from pain or injury and disease, freedom to express natural behaviours, and freedom from distress. There are five steps in the IKEA sustainable initiative for its leather supply chain, as shown in Figure 4.



(Source: summaries of interviews by author)

Fig. 4 Five steps of IKEA sustainable initiative for leather supply chain

Supply chain mapping

The first step is traceability, which refers to supply chain mapping. To have a clear picture on the existing leather supply chain, IKEA first conducted a supply chain mapping exercise. The leather supply chain is notoriously complex as the production involves many steps. Because of this complexity, IKEA had to revise its traceability target. Instead of securing a chain of

custody back to the farm by August 2017, it aimed to trace leather back to the slaughterhouse by the same date, while keeping the long-term ambition for a full chain of custody. In FY16, IKEA had already collected information on almost all of the slaughterhouses in its leather supply chain – one year before the target. That means it is very possible for IKEA to meet the goal by the middle of FY17. Frank Ouyang claimed that,

> *"To date, IKEA has the traceability in place - down to the slaughterhouse level, and what is ongoing is to have traceability to the farm level, which is more difficult but it is something being worked on during this year."*

IKEA mainly traces to the direct farm at the farm level, which is the first farm after the slaughterhouse level. During the rest of FY17 IKEA will continue to focus on securing a chain of custody verification routines and setting clear social, environmental and animal welfare standards.

Requirements development

The second step is developing IKEA Slaughterhouse & Transport Requirements. According to Frank Ouyang, IKEA has produced a traceability specification for the leather supply chain, which is IOS-MAT-0093, IOS is short for IKEA of Sweden, and MAT is short for material. This specification has been issued by Leo Chen, who is the Global Leather Engineer at the Leather Competence Center of IKEA. According to Leo Chen, this specification describes the traceability requirements for leathers used in IKEA articles, and the requirements are based on IKEA's commitment to social and environmental responsibility around the world. This specification addresses the manufacturers of domestic cattle leather and cattle hair-on-leather. The requirements for leather/hides originating areas are broken down into Brazil and the rest of the world. This is because Brazil is located in the Amazon region, which involves the forest conservation and biodiversity problems. With regard to Brazil, this specification particularly describes the requirements for protecting the Amazon Biome, which is mainly related to the issues of farms and slaughterhouses in this region. For both Brazil and the rest of the world, this specification describes the requirements for farms, slaughterhouses and manufacturers as well.

Pilot assessment

The third step is pilot assessments at selected slaughterhouses. Frank Ouyang said that,

> *"As now we have already traced back to the slaughterhouses of cattle, sheep and goat, the next step is that we are going to do the assessment of slaughterhouses. For example, in early August this year, we select 4 to 5 slaughterhouses in Australia to assess our requirements, including standards for animal welfare and transport, how to deal with the welfare of animals and how to solve the transport issues. In this assessment, we believe we will have lots of findings and learnings, which will help us to finalize the specification with a good improvement."*

There are three parties who will attend the pilot assessment, i.e. IKEA IWAY auditors plus one representative from the business team, representatives from tanneries, and animal welfare experts from the Food Animal Initiative (FAI). This step is the assessment of the developed requirements instead of a pass/fail audit for suppliers.

Finalize requirements and roll out

By the middle of 2017, the first and second steps have been achieved; the third step is what is ongoing now; the fourth step – finalizing requirements and an implementation plan and the fifth step – roll out, will be carried out later on. Based on the lessons learnt in the pilot projects, IKEA will finalize the requirement and roll out the programme to cover all supply chain partners.

Sustainability driven GS strategy and structure for leather

Peter Möller, the Category Area Comfort Sustainability Manager of IKEA of Sweden AB – Inter IKEA Group, stated that the goals for sustainable leather initiatives are 1) to have a traceability supply chain; 2) to set the requirements in the supply chain; and 3) to secure IKEA's requirement in this transparent supply chain. Peter further commented,

> *"When it comes to the requirements, it is of course about the animal welfare in the supply chain, but also about the workers welfare as well in the supply chain. Securing the animal and workers welfare in the supply chain is not so much to do with what kind of process that is used in the supply chain, it is more about the animal welfare in the supply chain. And regarding the workers welfare, it is mainly about ensuring the compliance of environmental section in IWAY within upstream supply chain. …"*

GS strategy for leather

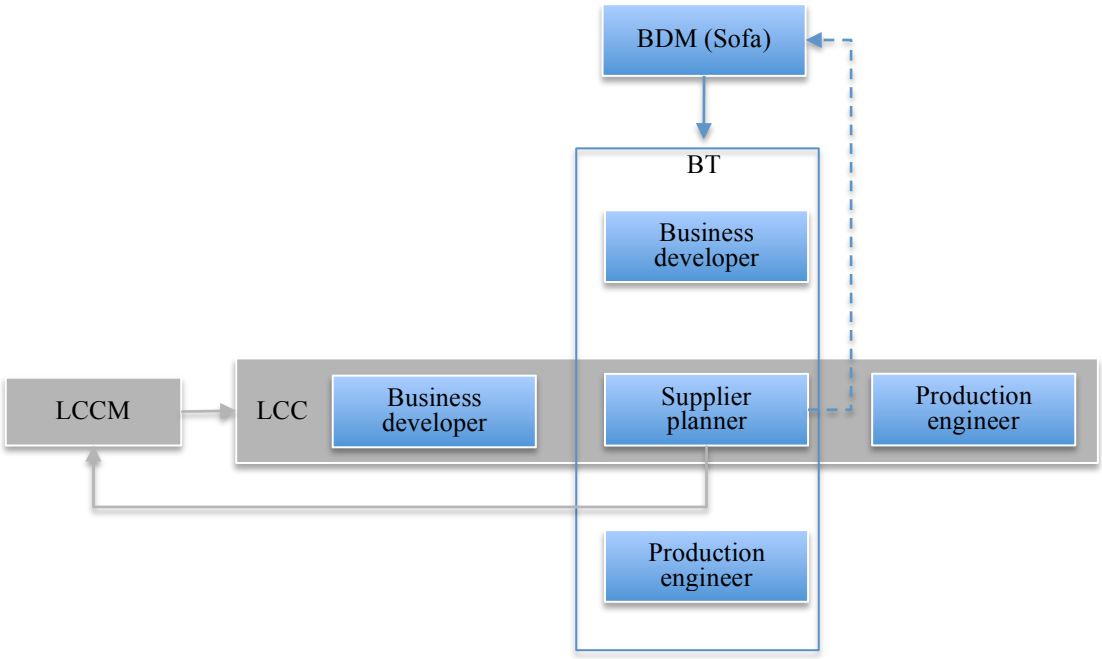
All the leather in IKEA is sourced globally by following the overall sourcing strategy. To enable a simple but professional leather SGS process, IKEA has a Leather Competence Center (LCC) that actually purchases all animal leathers. The home for leather GS in China is Shanghai LCC and the lead for the leather project is Frank Ouyang. The goals for the leather GS strategy include not only resource seeking and cost reduction, but also sustainability. According to Frank Ouyang,

> *"We purchase leather in the global scope, we have a lot of pre-conditions for leather global sourcing, for example, our raw hides of leather cannot come from the Amazon, because in some of its region, herdsmen deforest the forest for grazing, which will have a negative impact on not only the local indigenous peoples, but also the entire ecological chain; meanwhile, our raw hides also cannot come from the primeval forest area, even if it is not the Amazon region, because cutting down the forest in this area will also cause the destruction of the entire environment. Thus, we don't use the raw hides coming from these regions. Another point is that our raw materials are by-products, this is to say, animals are fed for meat instead of raw hides, after animals are slaughtered and meat is taken, the rest, i.e. raw hides is what we use. Furthermore, we don't use the raw hides coming from rare animals, this is a clear point in our pre-conditions. IKEA has three kinds of leather, cattle, sheep and goat, all of them are by-products."*

The main product in slaughterhouses is meat sold to meat-processing companies, e.g. McDonald's, which have high bargaining powers. IKEA has low bargaining power in their relationship with slaughterhouses as animal skins are a by-product and are sold with low value. In this case, it is not easy for IKEA to persuade the slaughterhouses to collaborate in the implementation of sustainable leather initiatives.

GS structure for leather

IKEA's leather GS work is highly internally integrated and is led by the LCCM with centralized planning and following a matrix management structure, as shown in Figure 5.



(Source: summaries of interviews by author)

LCC: leather competence center
LCCM: leather competence center manager
BDM: business developing manager
BT: business team

Fig. 5 Leather GS structure (matrix)

The Shanghai LCC is led by the LCCM – Frank Ouyang, and consists of a business developer, a production engineer and a supplier planner. The supplier planner also belongs to the sofa business team, which is led by the BDM of the sofa category. Differently from the typical matrix structure, which consists of *an operational* and *a functional line of reporting*, the GS of IKEA's leather follows a matrix structure composed of two reporting lines, both of which are based on products. For leather products, the supplier planner *line reports* to the LCCM; for sofa products, the same supplier planner *dotted line reports* to the BDM of the sofa category. In this approach, decisions can be made based on themes that are common to each product and costs can be cut as the supplier planner is able to perform cross-leather or cross-sofa activities. Moreover, besides the cross-product working groups, there are also other cross-organizational working groups covering topics such as energy, waste, circularity, community involvement and sustainability reporting. The cross-organizational working groups provide leadership, best practices, research and support on sustainable leather initiatives. With these two kinds of internal working groups' integration, IKEA's leather GS work is organized efficiently and economically.

Meanwhile, the GS of IKEA's leather also includes external integration with NGOs and suppliers. As IKEA sustainable leather initiatives are mainly focused on animal welfare and workers' welfare, when interfacing with suppliers, the LCC works together with the Food Animal Initiative (FAI) – a British NGO committed to better farming practices – and aims to provide knowledge about animal welfare to slaughterhouses and further to ask slaughterhouses to ensure animal welfare of their own suppliers – farms; while workers' welfare is the responsibility of the IWAY group, who check the IWAY of tier 1 suppliers and ask them to communicate and audit IMust requirements with nominated sub-suppliers, by using this approach until the end of the leather supply chain.

Conclusion

The implementation of SGS has led to several improvements for IKEA sustainability performance, including not only economic performance but also social and environmental performance. IKEA has achieved successful expansion in the global market and established close and long-term relationships with suppliers, performing global leadership through its sustainability agenda. The matrix structure has successfully followed the SGS strategy and allows a fast responsiveness and knowledge sharing within IKEA. The sustainable initiative for the leather supply chain illustrates that IKEA's strategy and the structure of SGS performs well in a complex global supply chain and represents a key lever that is useful to improve the general impact on sustainability in all Groups' compartments. Although until now the leather project is still on track, it is anticipated that IKEA will implement more sustainable initiatives and achieve a fully sustainable leather supply chain in the end.

For the future, what IKEA worries about are the limitations of the matrix management. There may be a conflict of loyalty between line managers and dotted line managers over the allocation of resources; projects may be difficult to monitor if teams have more independence; and employees may be confused by the roles that are played in different teams. Meanwhile, due to the low bargaining power IKEA has in leather GS, implementing sustainable leather initiatives still faces some challenges, such as how to persuade slaughterhouses to comply with the IWAY standards and with animal welfare, what the role of multi-tier suppliers is in auditing the IWAY standards across the leather supply chain, and how FAI transfers the knowledge of animal welfare to slaughterhouses and farms; these could be the directions for future studies.

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Analysis of operational efficiency of a halal meat processing supply chain

Jerin Varghese John, Balan Sundarakani, and Ioannis Manikas

Purpose:
The purpose of this paper is to analyse the factors affecting operational efficiency for a meat processing supply chain. The paper focuses on the operations take place in a slaughterhouse. The results obtained by testing a simulation model and the related factors mentioned are used to analyse the operative effectiveness..

Design / Methodology / Approach
The study takes place in the MENA region and in particular the UAE thus takes into account the Halal approach for meat processing. The ARENA software has been used to develop a process simulation model of a real time slaughterhouse processes scenario along with factors such as waste disposal, government regulation and Islamic Halal procedures that are also taken into account.

Findings:
The simulation model analysis shows that the current operational efficiency of the slaughterhouse processes is too low, as compared to the standard industrial operative efficiency. In the ARENA based process simulation, the parameters were varied and new resource utilization was obtained. By testing the new values into the relationship it was found that the operative effectiveness has improved to the initial results from 0.2193 to 0.2612. This study implies that there is room for improvement in the slaughterhouse facilities to achieve sustainability, and eco-friendliness by increasing the operative effectiveness.

Research limitation and implications:
Even though there is enough literature on operational efficiency of meat supply chain (Fattahi et al., 2013), very few researchers have focused on the slaughterhouse operations and the relevant supporting processes. Further refinement based on the factors that can affect the slaughterhouse operations needs to be studied. The data collected reflect the general aspects of the operations that are easily accessible; a study on the complete process carried out in the slaughterhouse supply chain would possibly support a better understanding of the factors and thus develop a better view of the operational efficiency of the slaughterhouse.

Practical Implications:
The analysis of the operational efficiency of the slaughterhouse may improve the slaughterhouse management practices to increase the performance. The managers and strategic decision makers need to decide on the appropriate mix of factors that would contribute to the improvement of slaughterhouse's operational performance. This study brings to light the improvement needs of the slaughterhouse facilities operate in this region in order to meet the food requirements of the consumers with utmost quality and by reducing the impact on environment which is a growing concern at present.

Originality / Value:
Although few researches have studied the aspects of waste disposal, government regulation, and resource utilization of a slaughterhouse facility, this paper investigates the operational efficiency of a slaughterhouse by considering all the aforementioned aspects by creating a

relationship among them which makes it a unique contribution to the meat industry. This study provides an insight on the operation aspects of the slaughterhouse and the common practices carried out in this industry thereby considering the dimensions and factors that can improve the targeted operational efficiency.

Keywords: slaughterhouse, halal meat supply chain, operational efficiency, ARENA simulation.

Introduction

Supply chain is a very broad term in the business world. It is generally defined as a network of facilities that deal with the supply and demand of the product and services. The network consists of people, activities, goods or services from one end to the other to meet the demand of the customer. The food industry over the past few years has been struggling to meet the expectancy in quality due to various reasons. With the increase in population, the need to meet the requirement for the large mass increased. This has had a very bad impact to keep the market responsive to the demands. There are various inhibitors that contribute to this decline in the food industry, such as government regulation on quality, processing ineffectiveness, infrastructures, distribution channels, poor handling, and customer practices. In such crucial time where the industry finds difficulties to meet the demand, cope up losses and reduction in wastages are affecting the world economy, overall environment and hunger levels. Thus attention to the shelf life of these perishable units play a very important role in the meeting the industry requirement. Food loss and wastage occurs at the pre-consumption and consumption stages. Hence, the need to improve to operating model is essential to have a good business model that can help to survive the current drop in the industry. Figure 1 illustrated a three stage comprehensive meat supply chain, which starts from farming and ends at the consumption.

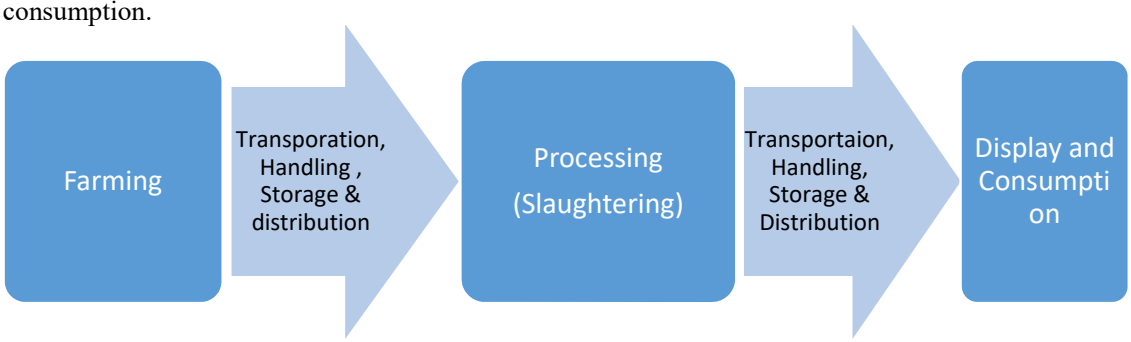

Figure 1: Three Tier meat Supply Chain

In the case of meat supply chain, livestock production and processing is the least efficient process with losses of more than 40% of food loses in the post-harvest and processing phase while in industrialized countries more than 40% of the loses and wastage are seen at the retail and consumer level, according to Gustavsson et al. (2011). With the increase in population, meeting demands could affect the environment by causing loss of diversity. To achieve effectiveness, the need for control system is required in the food industry. To gain maximum profitability, technology needs to be utilized efficiently in the food supply chain to stay aligned with the business expectation. Concentrating into the production section, which has the most implications in the supply chain, De Burgos et al. (2001) discussed the effect of operation objectives linking with environmental performance and supply chain issues. For example, in the food industry, customers are very keen on purchasing high quality products due to the potential health implications, apart from the government regulations, quality can

also be taken into consideration during the production time as this is the key area where the chances of quality degradation are found to be high. As estimated, in an average wastage of food accounts to 35% of the total output (Prafitt et al. 2010).

Literature Review

As per the international consumer research on meat-related requirements the quality related attributes be categorized into three areas; a) the meat quality as perceived by consumers b) meat safety as per the consumer attitude and c) mandatory quality and safety certification schemes of the meat supply chain (Krystallis et al. 2006).

Other important crucial factors to be considered in addition to the above mentioned three factors in food consumption are the religion and culture. Research has shown clear evidence in the past that religion as well affects the consumers' choices and eating habits (Delener, 1994). Some religions have direct clear instructions on how and what food can be consumed for example some pork meat is forbidden in Islam and Judaism or pork and beef in Hinduism and Buddhism except for Christianity that has no restriction on food (Sack, 2001).

This study takes place in the MENA region and in particular the UAE thus takes into account the Halal approach for meat processing. Halal is a credence quality attribute, an intangible feature of the food product that cannot be assessed by the consumer, even at a pre or post consumption phase (Grunert, 2005). Halal certification addresses the nature, origin, and processing methods of meat, applying similar approaches for sustainability and animal welfare as organic food production methods (Bonne et al., 2008).

The number of people requiring such credence quality attributes to be followed in food processing affects the consumption and requirements that shall be adhered to in the globalization arena which puts no limits or borders on the movements of food, goods, services labour or capital. All these complexity and inadequacy has dramatically increased the price for quality meat around the world and has attracted worldwide attention. (Sahin.et al, 2014) Presently the trends in meat consumption is changing at a rapid pace, this has resulted in the increased provision of meat products. The history of meat consumption is dated to prehistoric times; despite the meat industry is one of the most complex and problematic area concerning human diet. Over the past century, meat was considered as a luxury food product accessible to the elite class. The impact of Second World War and the overall increase in the global economy has led to the increase trend of meat consumption from early 1970s (Charlebois et al, 2010). This trend has led to increased demand and the global pressure for meat demand has propelled the price of meat products in various part of the globe.

Livestock products contribute to 33% of the protein consumption worldwide, globally it has been forecasted that by 2025 demand for meat products likely to increase rapidly (Rosegrant et al 2009). With the aspects of hygiene taken into consideration, the functioning of slaughterhouse s became vivid. Slaughterhouse function is meant for the production of edible portion of slaughtered animals to meet the meat protein demand for human consumption. Despite form other production unit, the level of hygiene is of prior importance. Such complexity would always lead to production inefficiencies. Therefore, understanding the process model and thereby measuring the efficiency of the processing unit of various operational processes seems to be imperative in the modern meat supply chain, especially places like the UAE where extreme temperature prevails during summer.

Research methodology

Phase 1:

Data collection from slaughterhouse operations:
In this step the slaughterhouse is visited and the procedures and process carried out and the data's regarding the time taken for the entity to pass from one process to another, the tine taken for an entity in a single process and human resource allocation for each process and the time over all time taken were observed in Figure 2.
Modelling and detailing of the process in simulation arena software.
The data's collected and the framework of the process carried out in the slaughterhouse facility are used as the input to the model created in the Arena simulation software. The analysis of the operations and the flow of products are modelled and then the data fed into the model and run over the replication of 10 times from a span of 12 hours a day.
Obtaining the report from the model and analysing the result.
The model is then tested and the output is obtained from the report generated by the software. The report would assist in assessing the factors that hinders the best performance of the overall process mentioned in the model. Also the alternatives that are required to make improvements in the operation cycle are analysed.

Phase 2:

Searching the literatures for factors affecting operative effectiveness
An extensive search through the literature review is carried out see the other core factors that impact the operations of the slaughter house are listed for further analysis.
Selection of key factors affecting slaughterhouse process
For a system, there are macro and micro environment factors that affect its operations, from the literatures the most critical and important factors are selected.
Calculation of contribution based on the secondary data
From the secondary data available from the literatures and online-published sources, the proportion of selected factors affecting the operations are calculated. Further, by the impact of the selected factors and their interdependencies the effectiveness is found which the sole purpose of this study is.
Simulation methods have always been used by manger as a management tool for production and processing environments to implement changes at strategic and operational levels. In this study, the simulation of the model represented in the below section is based on Arena simulation software prepared by Rockwell Inc. Discreet event simulation helps to understand the process with unique, specific events in time. These are mostly activity based modelling methods that are capable to accommodate flexibility in processes and simulate almost any processes in the industry. It provides a range of implications of the decisional changes before its practical application in the unit, thus reducing the uncertainties that would impact as a consequence on the operation dues to new changes implemented.
This would also help mangers in the industry to combine the layout, utilization of resources and space orientation to facilities in the production floor. The software allows users to enter data and design the features of the process intuitively with the following:

1. Real time decision making.
2. Addressing bottlenecks.
3. Increased reliability.

Data collection

In this study, data were collected from field measurement and observation of activities during the animal slaughter operation at a slaughterhouse located in Al Qusais was considered for the analysis. The research takes into account the whole process and activities occurring in the slaughterhouse facility. For understanding the various processes in the slaughterhouse

operations, an exploratory visit to the slaughterhouse was made and the measurement of time and the number of employees required for the different process in the slaughterhouse was observed. The model was created based on the field operation in the simulation software with the parameters and input variables observed from the field. The parameters include the time taken by an entity *(cattle)* to be processed through the various processing units across the production centre, time taken by employees to perform their function, the number of employees at each work stations; the resources employed for the business operations were gathered.

The second part of the analysis calculates the effect of the parameters selected based on the secondary data available and correlating it to the relation and there by formulating a formula based on the relationship and calculating the effectiveness of the operations.

The literature review depicts the various factors that would determine the effectiveness of the operations in an slaughterhouse facility. Among the various factors this study looks into the key aspect that affects its operation especially for slaughterhouse s that follows Islamic regulation for slaughter of animals for human's consumption.

1. Government regulation and Islamic laws
2. Human resource utilization for efficient productivity
3. Waste disposal

In accordance to mentioned factors in the earlier sections of this paper a model has been designed and the diagrammatic representation is as mentioned in Fig 2, each of these nodes represent the factors that contribute to the effective operation of an slaughterhouse facility based on the knowledge acquired from the various literature review. The arrows in the network of model also depict the causal relationship among the variables. The values for the mentioned factors are calculated for the factors and are depicted in the below section.

Data analysis

(i) Waste disposal:

Even with the existence of the state of the art technologies, waste disposal is one of the key areas that need attention with the rise of pollutant from the Slaughterhouse s due to huge investment behind it. Apart from the waste generated from the carcass there are lot of air pollution due to the contribution of Ammonia, Sulphur compounds and other effluents from the rendering process. When considering the statistics of live meats parts only 35 -55% seems to be edible rest of the portion needs to discarded as waste (Petrovic, et al , 2015)**.** The details regarding the statistics of cattle by percentage of weight typically for slaughtering are depicted in Fig 3. Animals that are slaughtered in the slaughterhouse include cow's sheep's, goat's, camels and veal's.

As mentioned earlier in the literature review with environment impact is of the highest concern around the globe, eco efficiency is being introduced to various industries. In the meat industry the requirement of safe environment is of highest factors due to rising risk of environmental changes that are encountered in the recent year. According the existing statistic, only the dung or manure is used for treatment process in sewage plants that contributes to 10% of the total waste products from goat.

(ii) Government Regulations and Islamic law

From the various literature reviewed in this article a set of factors were listed (Cost of the product, operations management in the slaughterhouse, waste management, location, implementation of halal slaughtering) and their requirement for 100% compliance were analysed and tabulated in the *table 1*. Further the percentage of contribution of government regulation on the slaughterhouse s operating effectiveness was calculated based on the number of factors that needs to undergo 100% compliance with the regulations. Also due to the lack secondary data's and journals regarding all the factors mentioned, a generic approach of analysis is selected for the analysis of the Government regulation factors. The analysis of this factor is based on the calculation of percentage of the effect of these represented sub factors by government regulation. The conclusion to these factors is based on review of government regulation on slaughterhouse management and halal food regulation.

Table 1 Contribution of factors

Factors requiring 100% compliance to Government regulation	**Yes or No**	**Percentage**
Costing of the product	NO	57.14%
Operations management in the slaughterhouse	NO	
Waste management	Yes	
Location	Yes	
Hygiene management system	Yes	
Design and Equipment	No	
Implementation of halal slaughtering process	Yes	

It is clear from the above table, based on the analysis it was found that 57.14% of the operation in the slaughterhouse are in accordance to the government regulation.

(iii) Human resource allocation and utilization

The model was created in Arena simulation software; the parameters are taken from the real life observation. The observation are based on time recorded by a sheep through the entire slaughterhouse process until the product, consumable meat is processed. For this observation, the slaughterhouse was visited and real time data's were collected. The parameters and their observations recorded were noted and were analysed to figure the inputs to the software. The following are the key fundamental blocks constituting the model of a functioning slaughterhouse:

Table 2 Process Involved

Sl No	**Process involved:**
1.	Sheep arrival dock

2.	Preparation for Halal slaughtering
3.	Slaughtering process
4.	Meat processing section
5.	Cleansing unit
6.	Slicing process
7.	Packaging process

Initial model

The mentioned process and the data's observed for the parameters are modelled using the software and the model as shown in Figure 2. The simulation model was tested and run for a period of 12 hours per day at a replication of 10 number. From the model, we can understand that many of the resources are utilized for system performance. For example in the cattle preparation area, a massive amount of water is used for the cattle preparation and cleansing of blood substrates from the meat to make the product hygienic and edible for human use. It is estimated that a sheep would require 100 -150L of water per animal from the simulation report. In this software the key main function used is process function with the triangular time function with minimum, most likely, and maximum. Since the arena software that is used is restricted to student version the use of advanced process and advanced transfer such as conveyors machines etc. could not be employed in this simulation model analysed for the study. For the conveyors in the original facility routes and station were used in the model as mentioned.

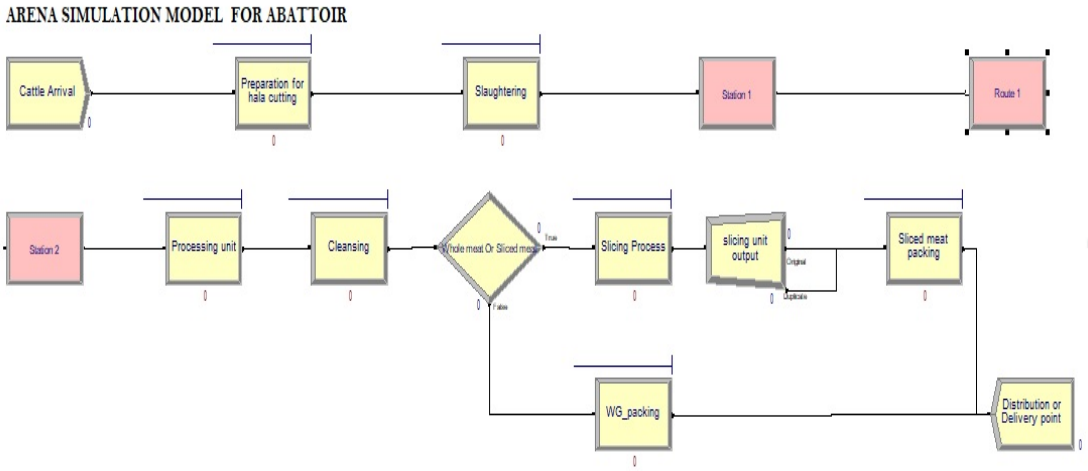

Figure 2: Arena Model for the slaughterhouse

Simulation and analysis of result

Based on the above assumption the model was created and the report was generated. The model was run for a replication of 10 with the working hours of 12 hour per day. From the result, it was found that in the system a lot of queue was observed at the following areas:

1. Preparation of halal cutting.
2. Processing unit
3. Sliced meat packing unit

The result was evaluated in minutes for the entire testing of the model. It helped to conclude that the average value time for a sheep was found to 10.5 minutes and the overall time a sheep would in waiting time to be 46.8 minutes, in depth analysis of the report has provided the time consumption of an average entity (sheep) in queue through the various processes in the system. In addition, the report showcases that at an average rate there are about 20 sheep's in the processing centre and 18 at the sliced meat packing section in queue from the testing carried out. The resource usage in this analysis has recorded highest utilization of resources at the processman_1 and SPacker_1 with 98.8% and 87.4% while the least utilization of resources' were cleaningStaff_1, resource manpower, and WGPAcker_1 with 10%, 16%, and 15%.This is being represented in the graph below. Since this study focuses on the operative effectiveness of the slaughterhouse functioning, many flaws can be identified in the process flow related to the functions. From the field observation, the area that was least focused on the simulation but plays an important role to elevate the effectiveness of the slaughterhouse .as mentioned in the earlier sections is the bio coding mechanism. It is a tracing techniques employed in many places but difficult to trace throughout the process due to the vast number of handling and process across the supply chain by the time the product reaches the slicing unit. Also the tracking and traceability is found to be poor after the slicing of the meat is carried also when the sliced product are packed the degree of traceability is very low. At this point, there seems to be no traceability as the number of sliced parts that are produced. Hence, apart from resource utilization there needs to an efficient tractability management and feedback system that can improve the quality of the quality of operation in the slaughterhouse.

While interviewing the workers in the line it was found that the processes in the meat processing unit have not changed from its beginning. The changes that they observe in the facility are the management's steps to maintain quality by repeated quality checks. The report from the arena simulation has provided the insight that resource utilization is partly been into effectiveness that is the processing unit and the cleansing unit. As the process involved in the process unit cannot be tailored due to the risks involved, the only way to increase the output is by structuring the process layout and optimizing the resource utilization.

When it comes to operation of any process related business model the needs for proper utilization is necessary. For this, the result from the arena modelling discussed above is analysed on the human resources utilization from the resource utilization. The result of the percentage of various resources employed in the operation line are as mentioned in the below table 6.

Further, based on an assumed scenario, the model was run to see the impact of human resource allocation and utilization in the arena software. With the variation based on the data received from the slaughterhouse the following changes mentioned in Table 3 were altered in term of the number of resources assigned were altered and tested to verify the usage of the human resources employed at each of the processes involved in the facility.

Resource name	Capacity
Slaughter_1	2
Process man_1	10
Cleaning staff_1	2
Butcher man _1	2
WGPacker_1	1
Spacker_1	5
Water	1
Resource manpower	2

Table 3 Tested values for resources

Testing the model with the above-mentioned resources for the same number of replication and length as of the original case test-run parameters were carried out and the result was obtained. By analysing the two reports the usage of with the changes have increased compared to the original case scenario and the outputs of the original case and the crested scenario from 38.39 to 45.72%. It is clear that the number of products produced remained the same for both the cases; this proves that there is scope for improvement in the resource utilization in the slaughterhouse facility as contrasted in the table 4.

Resource names	**Percentage of utilization**(Original condition)	**Percentage of utilization**(Scenario condition)
Butcher man	38.78	58.16
Cleaning staff	10.4	15.61
Process man	98.8	98.8
Resource manpower	16	39.91
Slaughtering section man	2.76	5.5
Spacker	87.4	87.4
WG packer	14.7	14.7
Total % utilization of the human resources	38.39	45.72

Table 4: Comparison of results

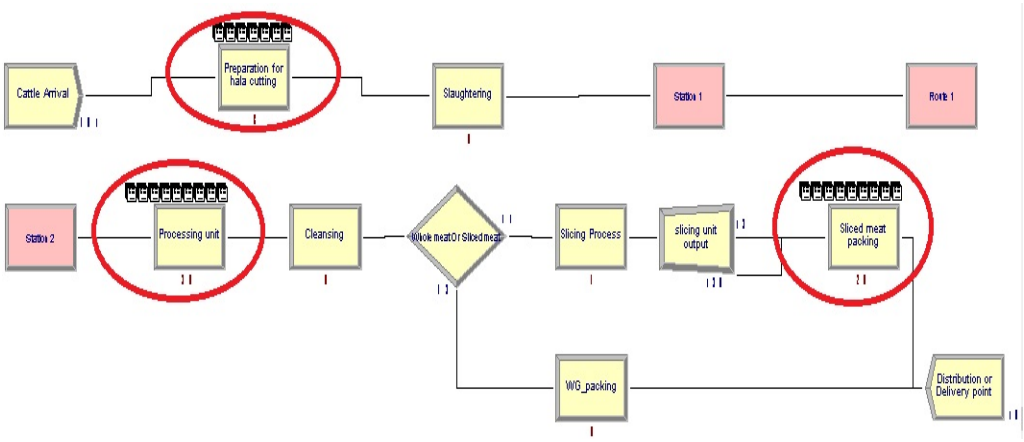

Figure 3 Revised model

From The revised model mentioned in Figure 4 above, the factors contributing to the effectiveness is measured based on the Overall Operational Effectiveness (OOE).

$$O.O.E = (Performance) * (Availability) * (Quality)$$ **.....(Eqn 1).**

The relation is formed from the basics that the overall effectiveness of system is the probability of success that the factor influence on the operations. In general, for a system the operations are influenced by these factors: Performance and Availability and Quality.

Conclusion

The proposed method of analysing the operational effectiveness using Arena simulation software, the parameters were varied and new resource utilization was obtained. By testing the new values into the relationship it was found that the operative effectiveness has improved to the initial results 0.2193 to 0.2612. This study thus implies that there is room for improvement in the slaughterhouse facilities to achieve sustainability, and eco-friendliness by increasing the operative effectiveness.

The managers and strategic decision makers are required to decide on the appropriate mix of factors that would contribute to the improvement of slaughterhouse operational performance. This study recommends improvisation of slaughterhouse facilities in this region thus able to meet the food (meat) requirements of the residence with utmost quality and by reducing the impact on environment from such facilities which is a growing concern at present.

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Generating the optimal supplier solution: A social capital perspective

Aki Jääskeläinen[A], Holger Schiele[B], Leena Aarikka-Stenroos[A] and Jussi Heikkilä[A]

[A] Industrial and Information Management, Tampere University of Technology
Korkeakoulunkatu 8, P.O. Box 541, 33101 Tampere, Finland. Tel.: +358 50 326 1113
[B] Technology Management & Supply, University of Twente
P.O. Box 217, NL 7500 AE Enschede, The Netherlands
(E-mails: aki.jaaskelainen@tut.fi, h.schiele@utwente.nl, leena.aarikka-stenroos@tut.fi and jussi.heikkila@tut.fi)

Abstract
This study answers to the following questions: can the availability of social capital in the supplier-buyer relationship explain supplier's solution provision performance, what is the importance of different forms of social capital in supplier's solution provision performance? The empirical data of this study consists of 662 survey responses which are analyzed with partial least squares (PLS) structural equation modelling. The results demonstrate the importance of social capital in obtaining the optimal solution from suppliers and the role of different dimensions of social capital especially in diagnosing customer needs.

Keywords: social capital, solution offering, supplier capability

Introduction

Supplier capabilities are increasingly important for the competitive advantage of companies (Hunt and Davis, 2012). Buyers and customers are seeking for means to identify the most skillful suppliers with the willingness to provide the best possible offering. Increasingly the most skillful suppliers can select the customers to whom they invest their best resources and provide their best solutions. This is the case especially with complex solutions, such as problem-solving for the customer or tailored combinations of products and services. Customers need more understanding on the antecedents of effective provision of offerings by suppliers. This challenge has been discussed in the field of value creation research stating that the optimal solutions and value are created through interaction between supplier and customer (Aarikka-Stenroos & Jaakkola, 2012). Thus, in solution business, it is critical to identify what improves the supplier capabilities and suppliers' value creation potential.

Earlier research has emphasized measurable technical characteristics (Ho, et al., 2010) of suppliers, such as certificates and delivery performance, but is also known that the collaborative attitude of the suppliers is essential (Schiele, 2006). A more balanced approach to examining the capabilities of suppliers in their solution provision is needed. Earlier research has identified that interaction between the supplier and the customer will develop joint understanding on what kind of solution creates optimal value, but it has not paid sufficient attention to the practices of suppliers' solution provision (Aarikka-Stenroos and Jaakkola, 2012). Our study aims to contribute to the existing literature by emphasizing the processual nature of solution delivery, i.e. it comprises different phases such as designing and delivering the solution (see e.g. Tuli et al. 2007; Aarikka-Stenroos & Jaakkola, 2012) Literature on solution business (e.g. Hakanen and Jaakkola, 2013; Jaakkola and Hakanen, 2013) has analyzed how solution provision should

be managed or solution elements integrated or customized. By this far, the factors improving the supplier's solution provision (Tuli et al., 2007) and especially its processual practices have not yet been analyzed. Therefore this paper focuses on the antecedents of suppliers' solution provision, particularly from the perspective interaction in the buyer-supplier relationship.

This study approaches the issue by taking social capital approach in the investigation. Social capital is a promising theory for supply chain research (Krause et al. 2007) and it has gained increasing attention in the last decade in the literature of business relationships (Lawson et al., 2008; Tsai and Ghoshal, 1998). The basic assumption is that the positive requirements for resource exchange between companies depend on the development of social capital in business relationships (Hughes and Perrons, 2011). However, the complex value creation through social capital in buyer-supplier relationships is still a topic requiring more attention (Hughes and Perrons, 2011). Many of the existing studies demonstrating the benefits of social capital in supply relationships concentrate on company or relationship performance benefits (Krause et al., 2007; Lawson et al., 2008; Villena et al., 2011) leaving the benefits in the form of practices applied by the actors with less attention. More studies can be found regarding the enablers of supplier's solution provision, e.g. social capital can enable the collaborative environment between companies (Leana and Pil, 2006). Social capital has been investigated in customizing the offering for the customer (Madhavaram and Hunt, 2017) but with focus only on the use of social capital in the internal interaction within a company when developing a solution for a customer problem. We begin with an assumption that social capital facilitates interaction between the supplier and the customer in solution business and thus contributes also to value creation potential of the focal solution. We therefore examine particularly social capital with relation to the supplier's capability to design and provide optimal solutions.

This study aims to understand the relationship between different dimensions of social capital and the performance of a supplier in its solution provision that realizes via interaction between the supplier and the customer. It seeks answers to the following research questions:

RQ1. Can the availability of social capital in the supplier-buyer relationship explain supplier's solution provision performance?
RQ2. What is the importance of different forms of social capital in supplier's solution provision performance and the different phases of solution provision?

The empirical data of this study is collected with a survey addressed to the suppliers of four large customer companies. The survey was sent to 1630 supplier companies and 662 usable responses were received resulting in a response rate of 41 %. Partial least squares (PLS) structural equation modelling (SEM) is used to analyze the data.

The results demonstrate the importance of social capital prevalent in supplier-buyer relationship in solution provision by a supplier. They provide understanding on the role of different dimensions of social capital in the phases of supplier's solution provision. The study utilizes a detailed view on the content of solution provision by differentiating the diagnosis of customer needs, solution design and solution implementation. The results demonstrate that different types of social capital have different influence on the phases of solution provision.

Defining solution provision and social capital

A general conception is that a solution is customized and integrated combination of goods and services which meets the business needs of a customer (Davies et al., 2006). Different viewpoints to solutions may prevail between suppliers and buyers: suppliers easily see solutions as a sum of products and services while customers highlight the importance of relational processes in the offerings including activities of customer requirements definition, customization of goods and services; and their implementation (Tuli et al., 2007).

Aarikka-Stenroos and Jaakkola (2012) identify five value co-creation activities by a supplier. This study concentrates on the three main activities: diagnosis of customer needs, designing a solution and implementing a solution. Since customers often lack a proper understanding of their needs, well performing suppliers may support customer in identification of needs for products and services. This is the case especially with inexperienced customers requiring support from suppliers for articulation of their problem (Aarikka-Stenroos and Jaakkola, 2012). Designing a solution involves specification of the problem and negotiation between supplier and buyer in order to reach a resolution. There is indication that this phase is the most important in creating optimal value in the relationship and also the most time-consuming and challenging (Aarikka-Stenroos and Jaakkola, 2012). Implementation of a solution mean the implementation or launch of outputs in the solution design process and it can support a customer to utilize the solution in the most efficient and effective way.

Social capital is an umbrella concept used in a variety of disciplines. The term social capital can be defined as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit" (Nahapiet and Ghoshal, 1998, p. 243). Thus social capital theory captures various dimensions of relational settings where companies co-create value and exchange resources (Nahapiet and Ghoshal, 1998). Social capital has been found to facilitate interaction, lubricate operations between actors and improve efficiency, and to glue actors together (Nahapiet and Ghoshal 1998). It represents the social ties between actors (both individuals and organizations) supportive to achieving certain benefits from these ties (Portes, 1998). Social capital captures the ability of companies working in networks in obtaining benefits such as access to knowledge, resources, technologies, markets and business opportunities (Inkpen and Tsang, 2005). Social capital can be used to analyze buyer-supplier relationships which include complex social processes where partners interact, exchange information, solve problems jointly and form interdepend relationships (Horn et al., 2014). Social capital has found to be a relevant antecedent for exchange of resources in such relationships (Hughes and Perrons, 2011).

Three dimensions of social capital have been identified: cognitive, structural and relational capital (Nahapiet and Ghoshal 1998). *Cognitive dimension* consists of shared interpretations such as codes, goals, norms and attitudes supportive to the social system (Horn et al., 2014; Tsai and Ghoshal, 1998). Shared culture and interpretations of the relationship and joint goals are important components of cognitive capital (Inkpen and Tsang 2005; Villena et al., 2011).

Structural dimension relates to the impersonal formation of linkages and existence of connections in a social structure (structural links) (Nahapiet and Ghoshal, 1998; Villena et al., 2011). Structural dimension can refer to the density of interactions and the number of connections in a social system facilitating the exchange of resources (Zaheer and Bell, 2005). Structural dimension and its benefits are ensured through frequent interaction at different examination levels and functions (e.g. marketing and purchasing) (Villena et al. 2011). The *relational dimension* relates to the relationships developed between persons during the time through interactions (Nahapiet and Ghoshal, 1998). Trust and commitment are important embodiments of relational component in social capital (Carey et al., 2011; Horn et al., 2014).

Hypotheses formulation

Previous literature indicates that different forms of social capital may be interconnected. Especially, there is evidence in the literature that cognitive and structural capital result in relational capital (Horn et al. 2014; Inkpen and Tsang, 2005; Tsai and Goshal, 1998). Common values between companies are supportive to the development of trust and avoiding of opportunistic behavior (Panayides and Venus Lun, 2009). Structural capital in the form of

information flows is supportive to the creation of relational capital (Carey et al., 2011). Social interaction ties developed over time are also important for relational capital (Horn et al., 2014).

Structural capital enables more frequent and diverse communication between companies (Krause et al., 2007; Lawson et al., 2008). In turn, communication can create value through driving problem solving (Stuart et al., 1998) and mutual understanding (Leuthesser, 1997), setting of priorities and coordinating activities between organizational parties (Mohr et al., 1996) which all can be seen essential enabler's for suppliers capability to provide solutions.

Cognitive capital consists of shared language between actors represented in shared goals, visions and values (Bolino et al., 2002). These in turn enable relationship partners to easier exchange their works (Inkpen and Tsang, 2005) and resources (Tsai and Ghoshal, 1998) arguably reflected in the supplier's willingness to invest in providing its best solutions. In turn, incongruent goals and values can lead to misinterpretations (Inkpen and Tsang, 2005) potentially harmful to supplier's solution provision.

Relational capital facilitates more intense and rich information exchange (Spekman and Carraway, 2005). Trust as a key embodiment of relational capital is supportive to open information exchange between actors (Ireland and Webb, 2007) and it can inhibit opportunism in business relationships (Liu et al., 2009). There is also indication in the literature that the presence of relational capital in buyer-supplier relationships can lead to higher investments in supplier development (Krause et al., 2007; Carey et al., 2011; Villena et al., 2011). These efforts by a buyer can in turn motivate suppliers in improving their solution provision.

Earlier research makes us suggest that social capital inherent in supplier-buyer relationships is supportive to supplier's ability to provide solutions. We provide the following hypothesis:

H1 Social capital and its sub-dimensions are positively related to supplier's solution offering performance

- Hypothesis 1a Structural capital is positively related to supplier's diagnosis of customer needs
- Hypothesis 1b Cognitive capital is positively related to supplier's design of a solution
- Hypothesis 1c Relational capital is positively related to supplier's implementation of a solution

Solution provision includes different phases, which have partly different characteristics. It has been presented that the understanding of customer needs requires that suppliers are close enough to customers in order to understand customer's value chain (Ravald and Grönroos, 1996). Suppliers need to ask the right questions and contact several actors in the customer company (Tuli et al., 2007). Development of solutions may benefit from inherent relationship with a customer (Rowley et al., 2000) while solution implementation also often requires interaction between companies due to, e.g. additional modification needs to products or services (Tuli et al., 2007). Tuli et al. (2007) proposed that solution effectiveness depends on both supplier and customer variables. As examples, a supplier's documentation emphasis and articulation of processes for solution development and in turn a customer's adaptation of its routines and processes to supplier's goods and services and provision of information and guidance of its operations to a supplier, can have a positive effect on solution effectiveness.

It is suggested that different forms of social capital may be needed in the phases of solution provision. This suggestion stems from the finding that different dimensions of social capital can have unique effects depending on the goals (Krause et al., 2007). Structural capital represents the structure of relationships between the actors while relational capital refers to the characteristics of these links (Hartmann and Herb, 2014). Close connection between customer

and supplier typically improves supplier's understanding of customer needs. Structural capital represent the relational ties while relational capital capture the strength of those ties (Krause et al., 2007). According to Moran (2005), structural capital is more important in execution-oriented managerial tasks whereas relational capital is important in innovation-oriented tasks. While diagnosis of customer needs and designing of a solution appear as innovation-oriented tasks, implementation of a solution is more execution-oriented task in solution provision.

Cognitive capital is important in achieving joint understanding of means to improve (Krause et al., 2007) and aligning objectives of interest. It is expected that shared goals and values support the supplier's understanding of customer needs as it enables the supplier better to diagnose the customer problem in order to design solution that fits to the customer problem (see also Aarikka-Stenroos & Jaakkola, 2012). They may also be supportive to the supplier's ability to design and implement solutions. We formulate the following hypothesis:

H2 Social capital dimensions are related to the different phases of supplier's solution provision

- Hypothesis 2a The sub-dimensions of social capital are positively related to supplier's diagnosis of customer needs
- Hypothesis 2b The sub-dimensions of social capital are positively related to supplier's design of a solution
- Hypothesis 2c The sub-dimensions of social capital are positively related to supplier's implementation of a solution

Earlier qualitative research has identified different phases in supplier's solution provision (Aarikka-Stenroos and Jaakkola, 2012; Tuli et al., 2007) and suggested that these phases are processual and inter-connected (Tuli et al., 2007). Solution design may benefit from good understanding of customer needs and good solution is required for its implementation. The prevalent understanding is that the phases are linked in a linear fashion while contrasting observations have also been identified (Aarikka-Stenroos and Jaakkola, 2012). In order to test the logic of the models in previous research, the following hypothesis is set:

H3 Phases of supplier's solution provision are positively related to each other

- Hypothesis 3a Diagnosis of customer needs is positively related to designing of a solution
- Hypothesis 3b Diagnosis of customer needs is positively related to implementation of a solution
- Hypothesis 3c Designing of a solution is positively related to implementation of a solution

Several control variables are used. Customization level of supplier's offering can have an impact on supplier's performance in providing solutions. More customized offerings may require more sophisticated practices for solution provision. Length of the buyer-supplier relationship may also have a role in the hypothesized relationships. Longer business relationships are characterized by trust (Lawson et al., 2008) and may drive a supplier to offer its best solutions. The company size may also explain the investigated relationships. Larger companies have often more sophisticated practices for their relationships. Finally, the importance of a customer as perceived by a supplier is a factor which may affect the supplier's willingness to invest its best resources in solution provision.

Methodology

A survey was directed to the key suppliers of four buyer companies. The four customer companies are large Finnish companies operating mainly in business-to-business markets. Two companies represent manufacturing and the two others service industries. Hence, the unit of

analysis of this study is the specific supplier-customer relationship between the respondent's company and one of the customer companies, from the perspective of the supplier.

The whole survey had four main themes: collaborative process, characteristics of the supplier-customer relationship, information sharing and performance and value creation. In this study, the sections of the study related to social capital dimensions and supplier's solution offering performance were utilized including 23 statements measured in 7-point Likert scale from 'strongly disagree' to 'strongly agree'. In addition, background information was collected concerning the respondents' employer companies. The survey instrument (see Appendix) was based on an extensive review of the literature. Existing survey statements were utilized when available. In some cases, the viewpoint of the question was switched from a buyer to a supplier. Also new statements were designed. The survey structure was piloted and tested with the intended population and fellow scholars. This led to small changes in wordings of the statements in order to avoid misinterpretations and to provide precise answers for measured aspects. Also some changes to the order of questions and subtitles in the survey were made.

The questionnaire was executed as a web-based survey. The survey was open for 3 weeks in May-June 2016. Two reminder messages were sent to the respondents. The test for non-response bias was done by dividing responses into three groups as follows: initial invitation, first reminder or second reminder (Leslie, 1972). T-test was performed to the research constructs and no statistically significant differences were found, indicating that non-response bias is not problem in our study. In total, the questionnaire was sent to 1,630 suppliers. 662 usable responses were received resulting in a response rate of 40.6%. The respondents of the survey were suppliers' contact persons (key account managers, CEOs and senior managers) in the relationship with a specific customer and thereby well knowledgeable on the particular customer relationships. Hence, there were typically only one response per supplier. Table 1 gives an overview of the respondents and their employer companies.

Table 1 Demographic information of the respondents' companies

Sample size	662
Company size in annual revenue 2015	Less than 2 million Euros 19.0%; 2 million - less than 10 million Euros 22.5%; 10 million - less than 50 million Euros 23.0%; 50 million - less than 100 million Euros 7.3%; 100 million - 500 million Euros 10.3%; Over 500 million Euros 16.0%;
Length of supplier-customer relationship	Less than 1 year 0.8%; 1 year - less than 3 years 6.2%; 3 years - less than 5 years 10.7%; 5 years - less than 10 years 15.7%; 10 years - 20 years 31.6%; More than 20 years 34.0%;
Key supplier status	Key suppliers 28.7%; Other suppliers 71.3%

The survey data was analyzed using the statistical software IBM SPSS Statistics 24 and SmartPLS 3.0. Partial least squares (PLS) structural equation modeling was applied to test the hypotheses. PLS SEM is a component based estimation method, which maximizes the amount of variance explained. It does not make assumptions regarding data distributions. PLS-SEM is specifically useful when the research focuses on prediction and explaining the variance of key target constructs. This study utilized PLS due the following reasons. First, PLS-SEM is purposeful in testing models with latent variables when the theory is less developed and the intention is to develop theory instead of testing one, such as in the case of our model (Hair et al., 2011). Second, PLS-SEM is an appropriate choice when models investigated are complex. Third, PLS-SEM can be used even if the variables are non-normally distributed. This study

used SmartPLS 3.0 to obtain the estimates. A bootstrapping procedure with replacement of 5,000 rounds was used in the analysis. According to the proposal by Peng and Lai (2012), we also tested the robustness of PLS results by applying OLS regression to the average values of the items in each construct. No differences in the main results (Tables 3 and 4) were identified.

Number of missing values varied between 5-15% in the statements used. Casewise (listwise) deletion was applied dropping the sample size to 460. Common-method bias was tested by 1) Harman's single factor test and 2) a test with a common method factor (Podsakoff et al., 2003; Liang et al., 2007). In Harman's test no single factor was accountable for the majority of variance in the data. The unmeasured common method factor test was conducted by following the approach presented by Liang et al. (2007). A common method factor was added including the indicators of all the constructs. The variance of each indicator was investigated in relation to its principal construct and the common method factor. The substantive variance of principal constructs was on average 0.660 while the average variance in the method factor was on average 0.006. The ratio between of substantive variance to common method variance is around 102. Further, most of the common method factor loadings were insignificant. Based on these tests we conclude that common method bias is unlikely to be a problem in our study. Table 2 summarizes the characteristics of the data used in this study.

Table 2 Characteristics of the data

Constructs	**Mean (s.d.)**	**Correlations**					
		1.	2.	3.	5.	6.	7.
1.Structural capital	5.05 (1.17)	1.00					
2.Cognitive capital	4.84 (1.14)	0.502	1.00				
3.Relational capital	5.82 (0.95)	0.573	0.552	1.00			
4.Solution offering performance	6.02 (0.73)	0.571	0.498	0.559			
5.Diagnosis of customer needs	6.02 (0.75)	0.512	0.492	0.555	1.00		
6.Designing a solution	5.97 (0.88)	0.532	0.400	0.483	0.636	1.00	
7.Implementing a solution	6.12 (0.82)	0.465	0.430	0.473	0.620	0.685	1.00

All Pearson correlations are significant at 0.001 level

All the constructs in the study are reflective in nature. Internal consistency and reliability were evaluated by using composite reliability (CR) (Fornell and Larcker, 1981), average variance extracted (AVE) and factor loadings (Hair et al., 2014) (results in Appendix). Composite reliability varied between 0.87 and 0.93, exceeding Nunnally's (1978) threshold of 0.7. AVEs varied between 0.56 and 0.72 exceeding the 0.50 cut-off (Fornell and Larcker, 1981) and all the Cronbach alphas were over the limit of 0.7 as proposed by Hair et al. (2014). Most of the survey items exceeded the 0.7 threshold for outer loadings (Henseler et al., 2009). One item with loading over 0.6 was utilized in the study. Cross-loadings for each item were examined by comparing the loadings into different constructs and by using the threshold of 0.2 for the difference. This resulted in the removal of three items in solution provision performance, two items in diagnosis of customer needs and two items in structural capital. Discriminant validity was tested as proposed by Fornell and Larcker (1981). The squared correlations between the

pairs of constructs is always less than the AVE for each individual construct. Multicollinearity was tested by using Variance Inflation Factor (VIF). The VIF values varied between and 1.36 and 2.09 (see Tables 3 and 4), which is well below the cut-off level of 10 often considered as indicator of serious multicollinearity (Duzann and Shariff, 2015).

Results

The first hypothesis regarding the relationship between social capital dimensions in the supplier-buyer relationship and solution provision performance was tested with the model 1 (see Table 3). The results suggest that each dimension of social capital is positively related to the ability of a supplier to provide solutions to its customer. Thereby H1 is supported. In addition, the results suggest that large size of a supplier company is positively related to its ability to provide solutions. The other control variables related to customization level of supplier offerings, supplier's perception of customer importance and long relationship length have no statistically significant relationship to solution provision performance. The model as a whole explains 44.3 percent of the variance in solution provision performance.

Table 3 Results for the hypothesis 1

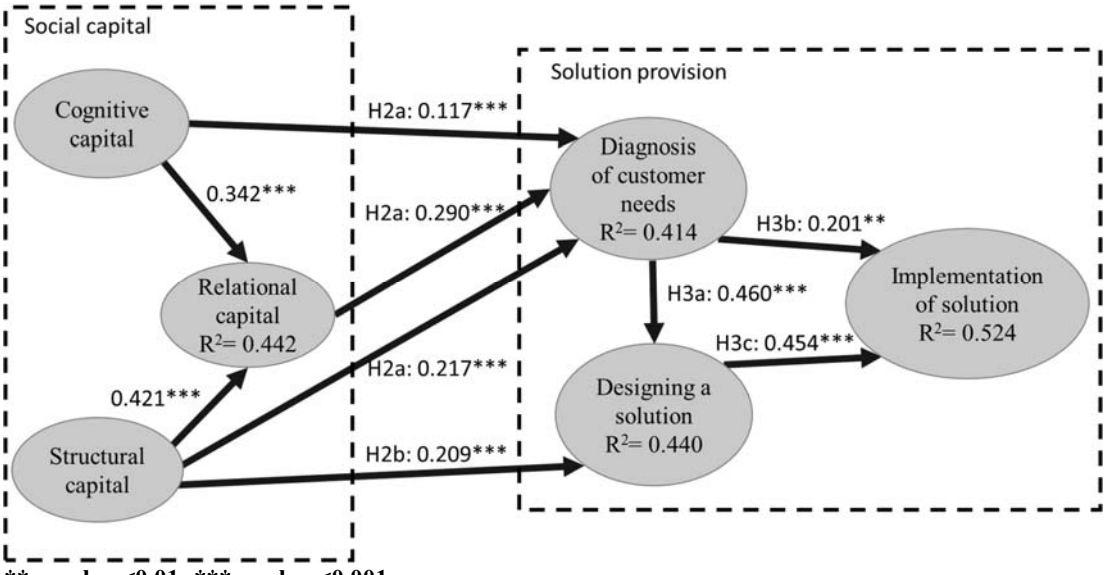
Path	**PLS SEM analysis results**					**OLS analysis results**		
	VIF	**β**	**t-value**	**Significance (p-value)**	**F^2**	**β**	**t-value**	**Significance (p-value)**
H1a Structural capital→solution offering performance	1.755	0.281	5.674	$p < 0.001$	0.088	0.294	7.029	$p < 0.001$
H1b Cognitive capital→ solution offering performance	1.642	0.180	3.951	$p < 0.001$	0.036	0.161	3.950	$p < 0.001$
H1c Relational capital→ solution offering performance	1.970	0.233	3.952	$p < 0.001$	0.075	0.238	5.377	$p < 0.001$
Control variables								
Large company size → solution offering performance	1.102	0.119	3.783	$p < 0.001$	0.023	0.087	2.616	$p < 0.01$
Customization level of offering → solution offering performance	1.024	0.079	1.954	N.S. (0.051)	-	0.091	2.822	N.S. (0.05)
Perceived importance of a customer → solution offering performance	1.353	0.088	1.903	N.S. (0.057)	-	0.115	3.092	$p < 0.01$

Long relationship → solution offering performance	1.086	0.035	1.051	N.S.	-	0.031	0.949	N.S.
R^2		0.443				0.425		
R^2adj		0.435				0.422		
Q^2		0.227						

In line with Hair et al. (2012), the effect size reflecting the relative impact of a specific exogenous latent variable on an endogenous latent variable (elimination of one path at the time) is examined using Cohen's effect size test (Cohen, 1992). The results of F^2statistics indicate that the size of the effect for all paths is small (above 0.02 but below 0.15) (Hair et al., 2014). Further test for predictive relevance of the model was carried out by applying Q^2 statistics through cross-validate redundancy approach (Hair et al., 2014) with satisfactory results.

Further analysis was carried out by applying polynomial regression analysis by comparing the two pairs of social capital dimensions at the time. The main observation of these analysis is that solution provision performance can be high even when one dimension of social capital is high in the relationship while the other is low. Due to the limited space these results are not presented here.

The second, more complex model was used to test the hypotheses 2 and 3. Relational capital appears as a mediator in the relationship between social capital and solution provision performance by a supplier as suggested in the prior literature. Figure 1 presents the significant relationships identified. Hypothesis two regarding the role of social capital in the different phases of supplier's solution provision is only partially supported. As suggested, all three dimensions of social capital are positively related to the supplier's ability to diagnose customer needs. However, only structural capital has a statistically significant positive relationship to a supplier's ability to design a solution. Formal structures and practices for information exchange seem important also in this phase but the result suggest that trust or cultural similarity in the relationship are not important anymore. Further, in implementation of a solution it appears that social capital has even less importance. PLS SEM result provide a weak support to the role of cognitive capital in this phase but OLS regression result is not significant. Overall, we conclude that social capital is least important in implementing solutions.



**** p-value <0.01; ***p-value <0.001**

Figure 1 The model 2 including significant relationships for H2-H3.

The third hypothesis of this study investigated the relationships between the different phases (diagnosis of customer needs, designing and implementing a solution) in supplier' solution provision. The hypothesis is supported. Diagnosis of customer needs has a strong, positive relationship with designing a solution. This suggest that the success in solution design is dependent on the understanding of customer needs. Understanding of customer needs also aids in successful implementation of solutions. Finally, success in designing a solution is positively related to the success in implementing of a solution. The results suggest that social capital contributes to the solution provision especially through its substantial role in supporting the diagnosis of customer needs which is in turn crucial in the other phases of solution provision.

Table 4 presents the results regarding the model 2 in more detail. PLS-SEM analysis suggest that the larger companies are more able to diagnose the needs of their customers and implement their solutions but OLS regression results do not provide support for this observation. The structural model explains 44.2 percent of the variation in relational capital, 41.4 percent of the variation in diagnosis of customer needs, 44 percent of the variation in designing a solution and 52.4 percent of the variation in implementing a solution.

Table 4 Results for the hypothesis 2 and 3

Path	**PLS SEM analysis results**							**OLS results**	
	VIF	**β**	**t-value**	**Signifi-cance (p-value)**	**R^2**	**F^2**	**Q^2**	**β**	**t-value**
H2a Structural capital → diagnosis of customer needs	1.770	0.217	4.258	p < 0.001	**0.414**	0.074	**0.236**	0.139	5.118
H2a Cognitive capital → diagnosis of customer needs	1.641	0.177	3.818	p < 0.001		0.033		0.112	4.231
H2a Relational capital → diagnosis of customer needs	1.807	0.290	5.194	p < 0.001		0.074		0.225	6.328
H2b Structural capital → designing a solution	1.852	0.209	4.038	p < 0.001	**0.440**	0.042	**0.315**	0.174	5.231
H2b Cognitive capital → designing a solution	1.693	0.002	0.037	N.S.		-		0.005	0.161 N.S.
H2b Relational capital → designing a solution	1.973	0.054	0.868	N.S.		-		0.057	1.289 N.S.
H3a Diagnosis of customer needs → designing a solution	1.704	0.460	8.355	p < 0.001		0.221		0.538	10.473

H2c Structural capital → implementing a solution	1.945	0.031	0.632	N.S.	**0.524**	-	**0.369**	0.010	0.347, N.S.
H2c Cognitive capital → implementing a solution	1.693	0.106	2.401	$p < 0.05$		0.014		0.054	1.943 N.S.
H2c Relational capital → implementing a solution	1.981	0.031	0.521	N.S.		-		0.046	1.191, N.S.
H3b Diagnosis of customer needs → implementing a solution	2.092	0.201	3.112	$p < 0.01$		0.041		0.272	5.483
H3c Designing a solution → implementing a solution	1.785	0.452	6.461	$p < 0.001$		0.241		0.421	11.041
H2 Structural capital → relational capital	1.361	0.421	9.672	$p < 0.001$	**0.442**	0.234	**0.304**	0.342	11.348
H2 Cognitive capital → relational capital	1.361	0.342	7.609	$p < 0.001$		0.154		0.293	9.592

The results of F^2 statistics indicate that the size of the effect for most significant paths is small (above 0.02 but below 0.15). For the path studied for H3 (relationships between the phases in solution provision) the F^2 is above 0.15 indicating medium effect. Only exception is the path diagnosis of customer needs → implementing a solution, which has a small effect. The result of Q^2 statistics through cross-validate redundancy approach suggest that the model has predictive relevance.\

Discussion and conclusions

This study demonstrates the importance of social capital prevalent in supplier-buyer relationship in supplier's solution provision: it particularly reveals how different dimensions of social capital contribute to diagnosing the customer need, designing and implementing the solution. This brings in several contributions.

Firstly, our study contributes to the literature of social capital in supply chains (Hughes and Perrons 2011; Krause et al. 2007; Villena et al., 2011) by unveiling the importance of different dimensions of social capital in the supplier's solution provision. This is one of the first studies examining statistically the antecedents of different phases in supplier's solution provision. Secondly, the study also proves the links between the phases in solution provision (diagnosis customer needs, designing a solution, implementing a solution) as suggested in the qualitative study by Aarikka-Stenroos and Jaakkola (2012). It gives support to the arguments highlighting the importance of understanding customer needs in realizing the innovation potential of suppliers (Larsson et al. 2006). Our study gives empirical evidence that social capital

contributes particularly to customer need diagnosis that determines crucially value creation potential in further phases of designing and implanting a solution. Thus our results build new knowledge particularly on the value creating process of supplier solutions and how different phases of that process are linked. Thirdly, this study contributes to the social capital literature by showing that different forms of social capital can compensate each other. When one dimension is missing the other has to be present in order to gain the desired benefits. This supports the argument by Nahapiet and Ghoshal (1998) highlighting the interdependence on the development of social capital. The study also supports earlier findings on the mediating role of relational capital in gaining benefits from structural and cognitive capital.

Our findings emphasize that the diagnosis of customer needs is the phase most significantly driven by social capital prevalent in the supplier-buyer relationship. This is understandable since diagnosis of customer needs tend to require emotional intelligence and ability to understand the role of a customer (Ravald and Grönroos, 1996). In designing solutions, structural capital remains important while the other dimensions of social capital lose their importance. Earlier research suggests that existence of relational capital may reduce the buyer's dependence on the service provider (Hartmann and Herb, 2014). In the relationships studied, it appears that formal and frequent communication structures are needed during the design of solutions reflecting the supplier's dependence on a buyer. Horn et al. (2014) identified that cognitive capital was more important than structural capital in relationships within a single company while the situation was the opposite in relationships between companies. While in inter-organizational relationships shared targets and values are important, the presence of contact points is even more important. This observation may also partly explain our results. Moran (2005) found that structural capital is more important in execution-oriented managerial tasks whereas relational capital is more essential in innovation-oriented tasks. Villena (2011) also proposed that relational capital may be more important than the other dimensions of social capital when supplier and buyer pursue strategic benefits. This would suggest that designing a solution is a more execution-oriented and less strategic task in comparison to diagnosis of customer needs which is not an easy argument to justify. However, there are varying presentations regarding the nature of solution process in the literature and the process may be affected by the nature of solution.

In the case of implementing solutions, social capital seems to lose its importance. This phase especially is characterized by independent work by suppliers while it is also known that sometimes solution implementation requires more interaction (Aarikka-Stenroos and Jaakkola, 2012) and consequently social capital. However, in our wide dataset of suppliers, solution implementation appears as something suppliers carry out rather independently.

The nature of problem to be solved can affect the characteristics of the solution process (Nordin and Kowalkowski, 2010). The customization level of supplier offerings was a control variable in this study and it was not found to have a significant effect on the findings, although slight indication was found that solution offering performance is higher when solutions are more customized. However, our results might have been different if suppliers with only customized solutions would have been included in the sample. Future empirical research on the relationship between different types of solution processes and social capital is encouraged.

The managerial implications of this study can be assessed from the viewpoints of both customer and supplier. The results give managers with more understanding on the importance of social capital in the supplier-customer relationships particularly in solution business. Our findings suggest that suppliers should analyze their solution provision process and practices, and identify potential means to improve it via social capital inputs. This is important especially in improving the understanding of customer needs. Our paper basing on statistical support advices

also managers to apply social capital along the path of good solution provision comprising the phases of good diagnosis, good solution design and good solution implementation. Traditionally the existence of these different phases has received limited attention and the responsibility for the phases is scattered in the supplier's organization, i.e. customer needs are defined by sales or business development functions while business or customer support functions play part in the implementation of solutions (Tuli et al., 2007). The implication is that the whole process should be taken into account through coordination between the functions. From the buying customer company perspective, the results support in understanding the importance of different supplier capabilities in service provision performance, which is crucial in eventual performance outcomes.

This study is not without limitations. Further research should address in more detail the compensating role of different dimensions of social capital in solution provision. Also the characteristics of a solution should receive more specific attention. This study was carried out with suppliers companies representing different sizes and industries and further study could concentrate on more specific types of suppliers. This study utilized supplier responses and a further study could extend the scope to the buyer company.

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Appendix: Measures, loadings, construct reliability and validity scores

Construct	Item	Item code	Loa-ding	CR	AVE	Cron-bach alpha
Structural capital	We communicate frequently enough with (CUST)'s personnel.	CPCOM1	0.739	0.907	0.620	0.877
	We have meetings frequently enough with (CUST)'s personnel.	CPCOM2	0.795			
	Our company and (CUST) share relevant cost information with each other.	PMSHAR 1	0.708			
	We set the strategic goals for the relationship together with (CUST).	PMSHAR 2	0.847			
	We have a systematic approach to sharing performance measurement information with (CUST).	PMSHAR 3	0.771			
	Representatives of our company and (CUST) meet regularly to review the performance of the relationship.	PMSHAR 4	0.855			
Cognitive capital	We have a similar organizational culture with (CUST).	RCOMP1	0.873	0.868	0.688	0.767
	Our company and (CUST) have similar management styles.	RCOMP2	0.889			
	Our cultural background does not create challenges in the relationship with (CUST)	RCOMP3	0.717			
Relational capital	We believe that (CUST)'s activities will be helpful to our business.	RCTRU1	0.835	0.887	0.724	0.809
	When it comes to things that are important to us, we can depend on (CUST)'s support.	RCTRU2	0.878			
	(CUST) keeps its promises to our company.	RCTRU3	0.838			
Diagn. of cust. needs	We assist (CUST) to articulate their needs concerning our company's products or services.	CPDIAG1	0.817	0.865	0.615	0.792
	We offer (CUST) alternative product or service options.	CPDIAG2	0.776			
	We understand the needs of <CUST> regarding…					
	product or service specifications.	CPDIAG3	0.787			
	product or service quality.	CPDIAG6	0.757			
Designing a solution	We are active in providing (CUST)'s business with the most appropriate solution.	CPOFF1	0.895	0.910	0.772	0.852
	We accelerate the joint design of a solution with (CUST).	CPOFF2	0.879			
	We offer additional products or services to meet those customer needs that arise during the delivery.	CPOFF3	0.861			
Imple-menting a solution	We have the capacity to support the implementation of our product or service in (CUST).	CPIMPL1	0.845	0.928	0.765	0.897
	We accelerate the fluent implementation of our product or service at (CUST).	CPIMPL2	0.868			

	We offer (CUST) long-term support in its use of our product/service.	CPIMPL3	0.903			
	We support (CUST) in achieving long-term benefits from our product/service.	CPIMPL4	0.880			

CR = composite reliability; AVE = average variance extracted.

Solution provision performance consists of: CPDIAG1, CPDIAG2, CPDIAG3, CPOFF1, CPOFF2, CPOFF3, CPIMPL1, CPIMPL2, CPIMPL3, CPIMPL4

28 YEARS OF TRACEABILITY MANAGEMENT: Trends, bottlenecks and opportunities

Dirk-Jan F. Kamann,[1*] Jose A. Alfaro[2], and Szabolcs Sebrek[3]

1 University of Groningen, Faculty of Economics and Business, The Netherlands, and presently Visiting Professor at the University of Pannonia, Faculty of Business and Economics, P.O. Box 158, Egyetem utca 10, H-8200 Veszprém, Hungary. Emails: dirk-jan.kamann@gtk.uni-pannon.hu or dirkkamann@yahoo.ca, tel +31.212 55 334/+36 204 508 131. *Corresponding author

2 Universidad de Navarra, Department of Business Administration, Campus Universitario, 31080 Pamplona, Spain. Email: jalfaro@unav.es tel +34.94 842 5600.

3 Department of Business Studies, Institute of Business Economics, Corvinus Business School, Fővám tér 8, Budapest,Hungary, e-mail: sebrek@uni-corvinus.hu

Abstract

This paper shows the evolution of traceability management from 1990-2017 using 124 articles. It lists 73 journals by name, classified in 12 fields of science. We find a dominance of food journals, with journals in supply chain management and IT in a stable second and third position. Articles are coded for 9 possible topics and divided into two categories: theoretical and empirical. An increasing Berry index for the 9 topics shows an increased dispersion across the various topics. Out of the 43 case studies, 36 relate to the food industry, although more recent publications also deal with other sectors. Various relevant theories are discussed and observed bottlenecks are discussed as well as future potential, like using Systems Thinking with Big Data Analysis as an enabler.

Keywords: Traceability, Supply Chain Management, Food industry, Literature Review

This paper will appear in the International Journal of Procurement Management (IJPM). Interested readers will be sent a personal copy of the full text after sending an email to the corresponding author.

Supplier relationships with competing customers -
How can purchasers find out who is the preferred customer?

Antonia Kappel[1], Holger Schiele[2], Wolfgang Buchholz[3]

ABSTRACT

Focal companies are embedded in complex supply networks consisting of various suppliers, customers, competitors and complementors. The activities of these actors influence the competitive position of the focal companies. Some customers achieve preferred customer status and gain preferential treatment, others have to restrain to being standard customers getting less privileged services. Consequently, buying companies in such markets have to achieve transparency about the relationships of their suppliers towards their competitors and complementors in order to map them and to analyse their impact. Current literature lacks a holistic approach to capture these relationships. In which sources can the focal companies find the desired information? Which kind of information do they really need? And in which situations is the need for transparency high and when is it low? The aim of this research is to examine these relationships using a World Café method with purchasers for data gathering followed by a Gioia method to structure the qualitative data. The result is a list of desired knowledge covering business, supplier and collaboration details; a set of information sources clustered in published and unpublished sources as well as contingency factors regarding general conditions, changes and particular occasions that require a high supplier relationship knowledge. All answers have been rated by their importance during the World Café. The answers can help to operationalise the mapping of supplier relationships towards competitors and complementors in order to assess the own customer status compared to other customers.

KEYWORDS

Preferred Customer, Supply Chain Mapping, Supply Chain Transparency, Supplier Relationship Management, World Café, Gioia Method

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INTRODUCTION

Increasingly, business-to-business markets are characterised by supplier oligopolies. Introducing tier structures and concentrating on a few strategic relationships has often resulted in a

[1] Research Assistant, Münster School of Business, FH Münster - University of Applied Sciences, P.O. Box 3020, 48016 Münster, Germany, Phone: +49 251 83-65610, Email: antonia.kappel@fh-muenster.de.
[2] Professor of Technology Management - Innovation of Purchasing, Production and Logistics School of Management and Governance, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands, Phone: +31 53 489 5615, Email: h.schiele@utwente.nl
[3] Professor of Logistic Management, Münster School of Business, FH Münster - University of Applied Sciences, P.O. Box 3020, 48016 Münster, Germany, Phone: +49 251 83-65612, Email: wbuchholz@fh-muenster.de.

reduction of the amount of competing suppliers. In such a situation, the problem may arise that suppliers do not treat all customers equally, which would also not make any sense from a resource optimisation perspective. Some customers enjoy preferred customer status, while others are treated as standard customers. The ones who achieve a preferred status derive greater benefits from suppliers' resources and capabilities and thus gain competitive advantage (Schiele, Calvi, & Gibbert, 2012). In order to understand their situation, firms need an even better understanding of their attractiveness towards their suppliers. They need to assess, whether they are sufficiently attractive to initially motivate a supplier to start a business relationship with them and at the long term to maintain it by satisfying the supplier. A customer is perceived as attractive by a supplier if the supplier in question has a positive expectation towards the relationship with this customer (Schiele, Calvi, & Gibbert, 2012). Consequently, firms need more supply chain transparency as compared to previous times where large numbers of suppliers were present.
Supply chain transparency is commonly known as the disclosure of information on involved actors (Doorey, 2011). The actors considered in this research are suppliers, customers, competitors and complementors according to the Value Net (Nalebuff & Brandenburger, 1997). Competitors and complementors will be summarised as other customers in the further course of the paper. Previous empirical research among purchasers has shown that the vendors' relationships' transparency as perceived by the buyers contributes to the overall success of a business relationship (Eggert & Helm, 2003). However, the current literature lacks a standard on the required knowledge about the relationships. Only proposals which information to gather exist, such as the suppliers' names and sustainability conditions (Egels-Zandén, Hulthén, & Wulff, 2015).

The analysis of the suppliers' relationships leads to a deep business knowledge in the supply network. This knowledge is useful for focal companies and can confer a competitive advantage on them. Furthermore, an investigation of the suppliers' relationships with competing customers might help to improve negotiation positions or to mitigate strategic risks (Hoffmann, Schiele, & Krabbendam, 2013). On the other hand, research on the complementors' relationships can help to increase sales. Therefore, both actors and their relationships in the horizontal dimension might create value for the focal firm.

In this paper, the World Café Method will be introduced as a suitable exploratory-qualitative research method to examine the knowledge of a focal company's purchasers concerning the relationships of its suppliers with other customers. This method will be complemented by the Gioia Method, which is used to structure the qualitative findings to subordinate constructs. In the end, the authors of this paper will sum up the relevant findings and give an outlook to potential fields of future research.

THEORETICAL BACKGROUND

Business-to-business markets currently face a high competition for resources (Pulles, Schiele, Veldman, & Hüttinger, 2016; Schiele et al., 2012). In many industries the amount and the capacity of the suppliers is limited and can cause bottlenecks in the supply. Especially in expanding or even booming phases of the business cycle, the situation is very serious and the suppliers cannot saturate all the existing demand. Natural disasters as well as the currency, politics, transport and further risks in a globalised world render purchasing activities even more difficult. Ensuring the availability of the ordered parts is the most important target of purchasers in these challenging times.

This development on the markets also leads to changes in the market power: In the past, suppliers fought hard to gain the orders of their customers (Schiele et al., 2012). Most purchasing

organizations had a list of preferred suppliers due to a competitive pricing and a convincing supplier performance. The supply market consisted of a broad range of interchangeable small to mid-size suppliers, whereas the manufacturing companies had a high manufacturing depth and owned most of the intellectual property on innovations. Nowadays, the customers cannot take the fulfilment of their demands as granted anymore due to an oligopolistic market structure (Schiele et al., 2012). The number of suppliers has significantly reduced to a remaining set of big, consolidated and powerful enterprises with a high innovation power and thus a very good negotiation position. Consequently, the customers need to struggle hard in order to become the preferred customers of their suppliers and to obtain preferential resource allocation (Pulles et al., 2016; Schiele et al., 2012).

According to Baxter, a very important determinant for the preferred customer status is the financial customer attractiveness. The supplier satisfaction and supplier commitment mediate this influence (Baxter, 2012). Supplier satisfaction is the buyer's ability to fulfil the expectations of the supplier (Schiele et al., 2012). It is influenced by growth opportunities, reliability and profitability of the relationship (Vos, Schiele, & Hüttinger, 2016). Moreover, Ellis, Henke and Kull state that early supplier involvement and relational reliability positively affect the preferred customer status (Ellis, Henke, & Kull, 2012). A high customer attractiveness can motivate the supplier to invest his limited resources in the common business with this customer (Baxter, 2012). Furthermore, the preferential treatment can be beneficial for product quality, support in the sourcing process, delivery and prices (Nollet, Rebolledo, & Popel, 2012) as well as the supplier's willingness to share new technology with this customer (Ellis et al., 2012). These ways of preferential treatment by the suppliers again increase the customer satisfaction (Bemelmans, Voordijk, Vos, & Dewulf, 2015). However, supplier satisfaction is an antecedent to preferred customer status and preferential treatment, but not an absolute value. Whether a customer receives preferential treatment or not also depends on the alternatives available to the supplier. Hence, for a buying firm it becomes important to understand what its competitors on the supply market are doing.

Consequently, it is very important for the focal companies to be aware of the relevant actors in their supply net and to map how the relationships between them are. The purchasers need to figure out the characteristics of their suppliers' business with other customers. They do not only try to learn more about the products and projects of their suppliers with other customers, but also about the collaboration between both parties. In order to create the desired transparency on supply chains, companies started to develop tools like supply chain maps.

These maps can have a structural or a geographic shape (Lambert, Cooper, & Pagh, 1998; Wilding, 1998). They visualize the material, financial and information flow into all directions of the supply chain and through a firm (Gardner & Cooper, 2003). The maps can show complex, overlapping links, if some actors on a higher level have relationships with various actors on a lower level of the supply chain (Smirnov, Shilov, & Kashevnik, 2006). Nevertheless, supply chain maps only focus on the vertical multi-tier supply chain. They present all sub-suppliers on the supply side and all trade levels on the sales side (Lambert et al., 1998; Wilding, 1998). This paper tries to take supply chain visibility a step ahead. By integrating a horizontal dimension in addition to the vertical supply chain, it considers the whole supply network. According to the value net by Nalebuff and Brandenburger, the important actors in the horizontal dimension are the competitors and complementors of the focal company, as both influence its strategic position on the market (Nalebuff & Brandenburger, 1997).

Once the purchasers know who has a preferred and who has a neglected status for their suppliers, they can define or review their preferred customer strategy and adopt their supplier rela-

tionship management. For this purpose, they can reflect on the reasons for their own (un)attractiveness and try to improve the supplier satisfaction in order to maintain their preferred customer status or to be upgraded to a preferred status (Schiele et al., 2012). They can adjust the supplier classification and focus on those suppliers who treat them as preferred customers. They might stop the collaboration with suppliers who have a trustful relationship with their competitors or intensify projects with suppliers who closely work together with their complementors. Moreover, they can develop another strategy for the suppliers who treat them as preferential customers and try to reduce purchasing costs or to achieve other advantages from them.

To the authors' knowledge, no broad investigation on the information gathering about the relationships between these actors exists yet. That is why this research concentrates on the purchasers' transparency about supplier relationships with other customers. Regarding the preferred customer theory, the aim is to investigate the following research question: How can purchasers assess their own customer status at their suppliers in comparison with other customers?

RESEARCH DESIGN

World Café Method

The World Café is an exploratory-qualitative research method that has been created by Brown and Isaacs (Brown, Isaacs, & Community, 2005). Small focus groups discuss on selected subjects in a café-like atmosphere (Prewitt, 2011; Wibeck, Dahlgren, & Öberg, 2007). Seven core design principles constitute the basis of the World Café method, such as exploring questions that matter or connecting diverse perspectives (Brown et al., 2005; Fouché & Light, 2010; Lorenzetti, Azulai, & Walsh, 2016; Tan & Brown, 2005). The advantages of the method lie in its high output attainable in a short period of time compared to other qualitative research methods such as longitudinal case studies or interviews. In contrast to interviews, an exchange among the participants is possible and desired. Due to the iterative process of the World Café method, a high stability and reliability of data is ensured (Kidd & Parshall, 2000). Varying group constellations enable to achieve rich data and to reduce bias (Fouché & Light, 2010).

The aim of this research is to create a deep and collective understanding on how to assess the customer status by the help of a small group of purchasers. That is why a single case study is suitable to explore the problem instead of a multiple case study analysing the similarities and differences across various cases. The method is applied in an agricultural machinery company, as this firm faces a complex, multi-tier supply network including various suppliers, competitors and complementors and does not carry out a holistic approach to achieve an overall transparency on it yet. In order to form a representative sample of the product-related material purchasing team in this company, five divisions are involved in the World Café session, thereof three manufacturing facilities buying production material, the aftersales division ordering spare parts as well as corporate functions. The heads of purchasing select 14 purchasers, so that at least three buyers and the moderator take part in the discussions at each table.

Important criteria for the selection of the participants are a heterogeneous experience and portfolio among the group. The heterogeneous portfolio enables the authors to examine if the need for transparency depends on the commodity. Represented commodities are assemblies, axles, bearings, belts, cabins, chains, drivelines, electrics, electronics, gearboxes, hydraulics, machined parts, metal sheets, OEM parts, plastics, power train, pulleys, rims, rubber, service provider parts, special tools, tyres and weldments. An average participant of the World Café has worked for the agricultural machinery company since 13.6 years - thereof 11.5 years in strategic

purchasing at this manufacturer – and is responsible for 44 suppliers. With regards to the professional level, nine strategic purchasers, one lead buyer, one head of purchasing as well as three purchasers in corporate functions form the group. The purchasers in the corporate functions are responsible for contract management, product cost optimization and product-related material. Only two participants have taken part in a World Café session previously.

At different stations, the purchasers answer the following questions and change groups after each round. According to the World Café design principles, questions should be powerful and appreciative (Brown et al., 2005; Alexander Schieffer, David Isaacs, & Bo Gyllenpalm, 2004). Questions 1 and 2 are discussed on separate tables regarding competitors and complementors, but lead to similar results, which are presented together in the findings sector.

Q1: ***What*** *would you like to know about your supplier relationships with other customers?*
Q2: ***How*** *do you find out information about these relationships?*
Q3: ***When*** *do you need a high knowledge about these relationships?*

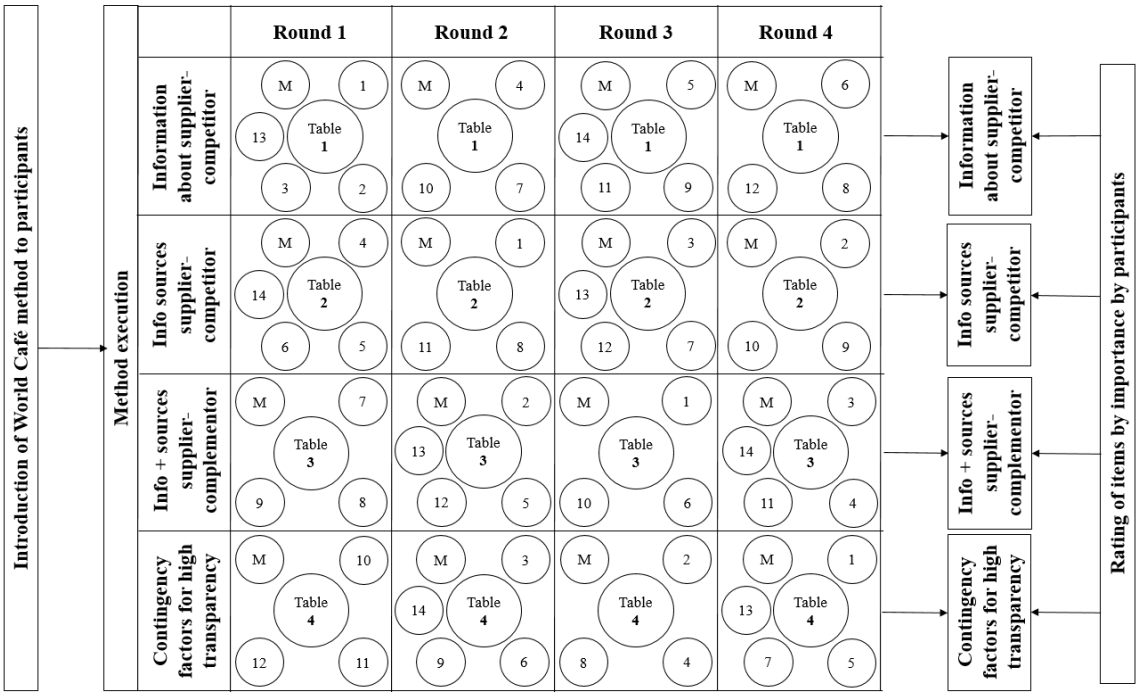

Figure 1: World Café design and application

The numbers in the World Café design in figure 1 illustrate how the participants mix when rotating between the tables in order to maximise knowledge exchange (Chang & Chen, 2015; Prewitt, 2011). The table constellations are announced by the café convenor for each round to ensure that there are new constellations every time and that the participants of the different company divisions mix with each other. In the beginning, each participant draws a number and then changes the tables accordingly. As figure 1 demonstrates, the same participants do not meet each other in the same discussion group more than twice. While the participants move, the moderators remain on their tables. They take notes, make sure that discussions stick to the subject and that every participant can contribute to them. Finally, they sum up the findings for the new group (Hüttinger, Schiele, & Schröer, 2014; Alexander Schieffer, David Isaacs, & Bo Gyllenpalm, 2004). Movable walls and paper sheets are used for documentation (Pumpe &

Vallée, 2016). When noting down the answers, it is very important to use another pen with a different colour for every new round in order to track the progress.

The discussion rounds are recorded, so that no important suggestions are lost due to the tension in lively debates. All audio files are transcribed after the World Café session. These transcripts allow to write a clear definition for every suggested answer listed in the attached glossary. The definitions avoid misunderstandings of the key words on the paper sheets and provide additional explanation. Therefore, they also help to detect overlaps in the answers and to condense them to one single answer.

Four rounds take place each lasting 20-30 minutes, so that a two-hours-time span for the method execution is sufficient (Jorgenson & Steier, 2013). Experience has shown that usually the first session should be the longest and is therefore scheduled with 30 minutes. Most participants have not taken part in a World Café before and they need to get familiar with the questions, colleagues and moderators first. Moreover, there is often a natural resistance to get started with creative techniques. Furthermore, the participants can still mention any aspect that they regard as important, whereas the scope of discussions narrows down from round to round. The second and third round serve mainly to ensuring that all ideas are covered and are thus five minutes shorter. The last round aims at filling the gaps and takes about 20 minutes.

In the end of the World Café session, the participants are requested to fix stickers next to the answers according to the significance of the suggested aspects (Pulles et al., 2016), in order to provide a ranking of the answers collected in the World Café. Another hour is necessary for the evaluation and the closing session. Each participant gets stickers in different colours for the different questions. Six stickers are distributed per question, multiplied by the 14 participants, resulting in a voting of 84 points per question. As there are many answers, all possible ways are allowed for the rating, such as giving all six points to one answer or splitting them up to several answers. Once all stickers are on the paper sheets, the moderators start counting the points per answer. They sort the answers in a descending order by the number of received answers in order to figure out the most important answers for the group. This order can be seen in the ranking tables (figure 3, 5 and 7), which are presented in the findings section. Finally, the moderators present the top responses as the findings to the World Café's participants.

Gioia Method

In order to enhance the qualitative rigor of this inductive research, the World Café is complemented by the Gioia Method. This method is a holistic approach to inductive concept development. The huge advantage of this method is that it clusters the answers given by the participants of the World Café and creates a structure of this qualitative data. This data structure facilitates the integration of the World Café results in the focal company's supplier strategy and supplier relationship management. Although the Gioia Method was developed based on semi-structured interviews, it is just as fitting for the World Café with focus groups, as both methods serve obtaining retrospective and real-time accounts by those people experiencing the phenomenon of theoretical interest (Gioia, 2012).

The analysis of the qualitative data according to the Gioia Method starts with the creation of 1st-order categories by seeking redundancies or high similarities between answers of the focus group. Although the number of categories should be manageable, the effort to merge different categories is still low at this stage. In the next step, several categories are condensed to 2nd-order themes on a more abstract, theoretical level explaining the observed phenomena. In the end of the analysis, these themes are again aggregated to higher dimensions (Gioia, 2012).

In order to build the 2nd-order themes and aggregate dimensions for this research, the posters of the discussion rounds with the purchasers as well as the attached glossary are a big help in order to understand the broader context behind single noted down answers. They give a first indication for the clustering of the answers. A graphic representation for every question in the findings section shows the data structure of 1st-order categories, 2nd-order themes and aggregate dimensions. The dimensions help to generalize from this case study to other manufacturing companies, as the collected insights on the desired knowledge, information sources and contingency factors on supplier relationships are also relevant to other industries.

FINDINGS

The results section describes the data structure according to the Gioia Method followed by the rating of the answers coming from the World Café approach for each question. This structure allows presenting the findings in a logical sequence, although chronologically the results in the World Café were collected first. For the first two questions, most answers regarding the supplier relationships with complementors were the same as already mentioned for the competitors. However, some answers were only given for complementors. These answers are marked by a star (*) in the data structure figures 2 and 4. They give additional insights, as the relationship of the focal company with complementors differs from the relationship with competitors. The answers marked by the star (*) can be looked up in the attached glossary, but are not included in the rating figures 3 and 5.

Q1: Desired relationship knowledge

As illustrated in figure 2, the purchasers are interested in the business that suppliers make with other customers. This business can be expressed best by its commercial facts: Which products are in the delivery scope of the supplier? At which price level? And how much turnover does the supplier make with other customers? Besides this financial perspective, also more background on the business partners is interesting for the purchasers: Are the suppliers unknown for the focal company and consequently new, potential suppliers? How dependent are the other customers of these suppliers? And do they deliver directly to their aftermarket?

Moreover, the purchasers of the focal company would like to find out how other customers deal with suppliers whom they both have in common: How do they handle and manage these suppliers? Assessment-related answers given in the World Café are the supplier classification, evaluation and audit results. Concerning the management of the suppliers, the purchasers would like to know which targets they set for suppliers, how they award projects to and how they optimize processes of the suppliers.

Finally, the buyers would like to discover how the collaboration works between the suppliers and other customers. They would like to know existing legal and logistic agreements like the contract and delivery agreements for the different plants. Furthermore, they are interested in the innovations developed by their common R&D staff as well as the interpersonal exchange: How is the cooperation strategy? How often do they meet? Does the supplier offer an open-book policy for them?

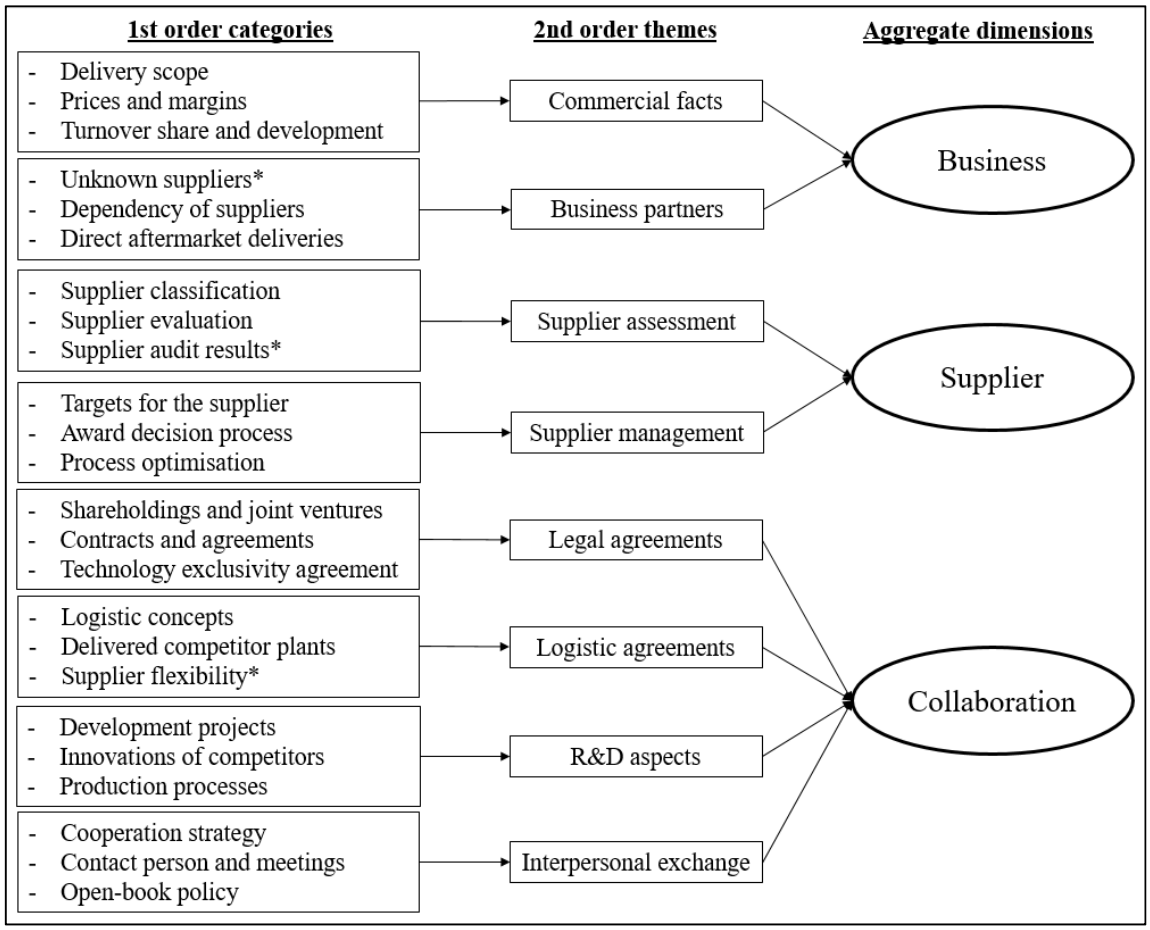

Figure 2: Data structure of desired relationship knowledge

As figure 3 shows, the most desired information mentioned in the World Café are the prices and margins that the supplier grants the competitor. The purchasers placed 15 stickers on this top response. The prices were rated as very important regarding supplier-complementor relationships, as well. However, the aim to figure out this information for the complementors is not the same as for competitors, as it might make sense for complementors to align their prices to each other and to raise or lower them by mutual consent. The managers of an airline would like to know when destination resorts lower their room rates, as the demand for flights will rise. This management of the complementor's relationships describe Yoffie and Kwak as "knowing your friends". (Yoffie & Kwak, 2006).

Another important financial KPI being assessed with 8 points is the turnover share and development that the supplier makes with the competitor. However, not only financial facts are highly important to the purchasers, but also other parameters describing the supplier-competitor business, e.g. if the supplier delivers directly to the competitor's aftermarket (8 points) or if he supplies to his global plants (13 points): Do the supplier and the competitor go local-for-local? If he were willing to implement the corresponding structural and processual changes with other customers, maybe he would agree on the same strategy with the focal company.

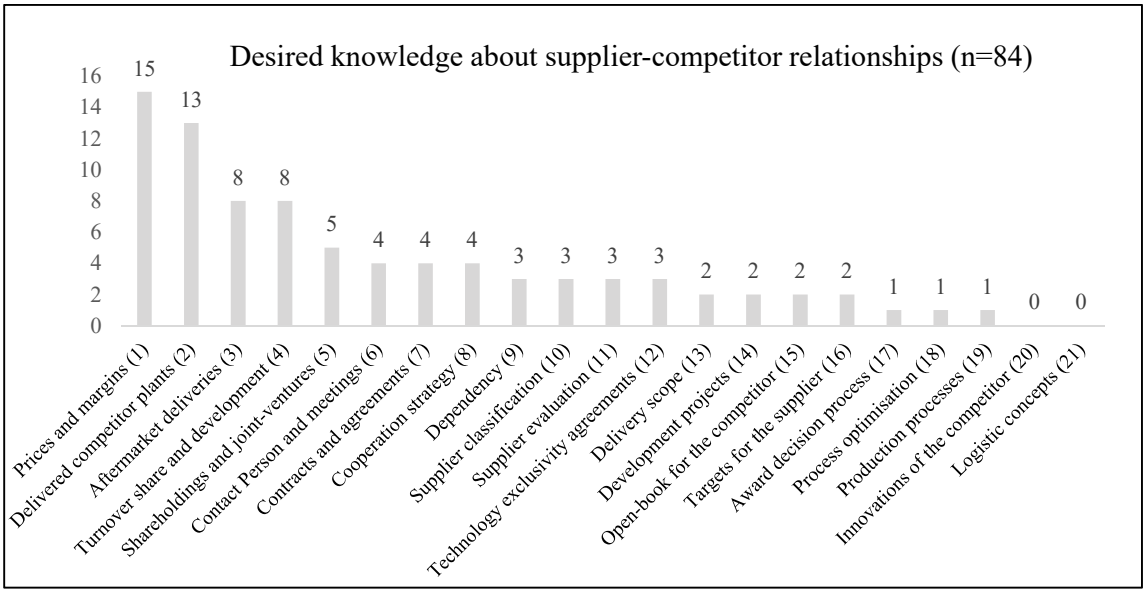

Figure 3: Rating of desired relationship knowledge

The desired relationship knowledge presented in this paper contributes to the current literature examining the different dimensions of customer attractiveness and supplier satisfaction (Pulles et al., 2016). Some mentioned answers correspond to the outcome of the World Café presented by Pulles et al. and thus render the findings of these authors more robust. Other aspects are new and complement the outcome of the previous World Café by valuable additions.

More precisely, the purchasers in this research mention the same following dimensions of customer attractiveness as in the World Café of Pulles et al.: supplier development programs, open-book (providing suppliers access to advanced knowledge), supplier flexibility, top-management interest (which can be derived from the contact person and frequency of meetings), turnover (corresponding to the purchasing volume of the buyer), firm strategy and exclusivity agreements (Pulles et al., 2016). New additional dimensions of customer attractiveness from this research are: prices and margins, direct aftermarket deliveries, process optimisation, shareholdings/joint ventures, contracts/agreements, logistic concepts and delivered plants.

Concerning the dimensions of supplier satisfaction, purchasers in both cases mention: the supplier rating (corresponding to supplier evaluation), the turnover development (equivalent to the growing purchasing volume from the buyer's perspective) as well as joint developments and innovations (Pulles et al., 2016). However, some interesting, new answers from this research can be added to the dimensions of supplier satisfaction: dependency of the customers on the suppliers, supplier classification, supplier audits, targets for the suppliers and the award decision process.

Q2: Information sources

Potential information sources for the supplier relationships with other customers can be differentiated into published and unpublished sources as demonstrated in figure 4. Media belongs to published sources as well as events. Media does not only cover print media in form of specialized press, but also internet search engines and internet-based RfQ platforms. Concerning complementors, the following documents are worth reading: industrial reports (Kumar, Srai, Pattinson, & Gregory, 2013), industry forecasts, scientific reports, annual reports, newspapers, professional magazines, trademark registrations and patents (Ojasalo, 2004). Events are usually

organized by fair organizers and associations. However, sometimes activities take just place on the market and thereby inform third parties about relationships.

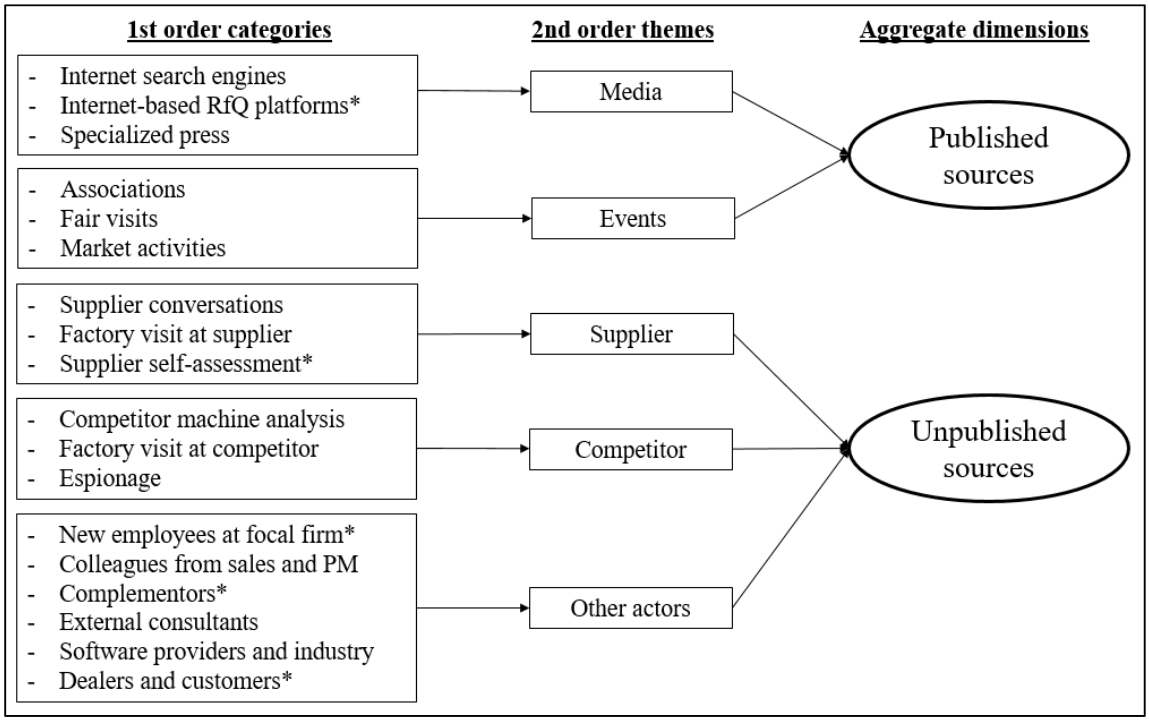

Figure 4: Data structure of information sources

Several actors can be counted to the unpublished sources meaning that they reveal information in an informal, confidential context: The most obvious of these sources is the supplier himself, who either speaks frankly with his contacts of the focal company or who gives information unintentionally during visits at his plant or because he has to do so in self-assessments for the application for new customers. The competitor tends to be more restrictive with his data, yet sometimes his plants may also be visited or one of his products can be analyzed. Espionage is another theoretical way but illegal and therefore excluded for further considerations. Furthermore, it is regarded as helpful to talk to colleagues from other departments or to new colleagues about the suppliers. Complementors, external consultants, software providers and dealers are further promising sources of supplier relationship information.

Rated by 16 points each during the World Café, the purchasers regard both factory visits at the supplier and conversations with the supplier (Ojasalo, 2004) as the most promising information sources regarding relationships with competitors. For relationships with complementors, the score is even higher, as the information policy is obviously more open regarding complementors being considered as friends of the focal company. There are several contact persons at the supplier who might provide the required information: the sales contact, back office employees, the project leader or the responsible engineer.

With eleven points on the second rank, the purchasers regard the exchange with colleagues as highly important. Networking helps to achieve information, team meetings provide also an important platform to exchange with colleagues. The technical approach via a competitor machine analysis is evaluated just as important by the purchasers with eleven points, too.

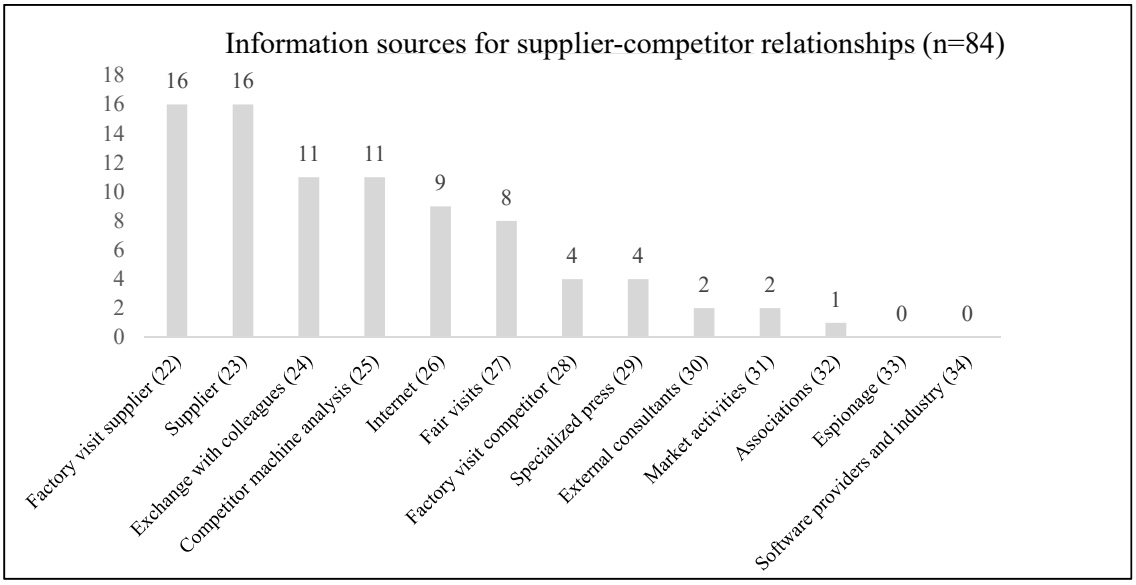

Figure 5: Rating of information sources

Q3: Contingency factors

The contingency factors can be clustered in general conditions, changes and particular occasions as demonstrated in figure 6:

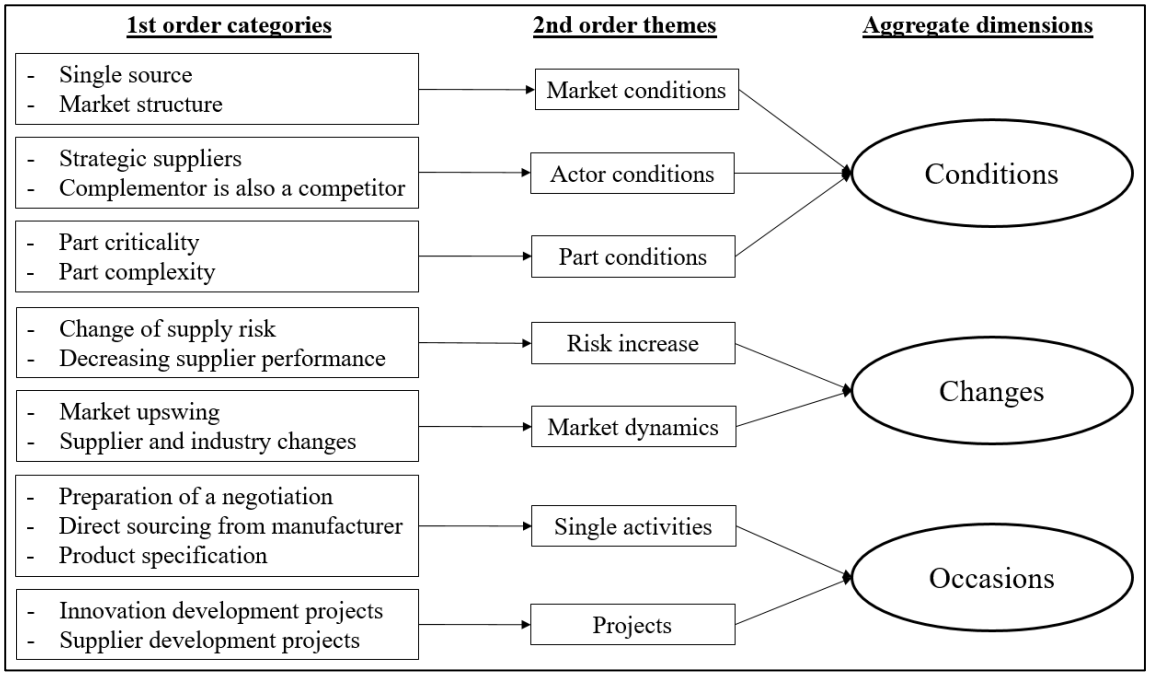

Figure 6: Data structure of contingency factors

The conditions cover the market with his structure and potential alternative sources. The purchasers give seven points to this answer during the World Café. If the focal company is a monopolist, it does not have to bother about relationships that might potentially improve or endanger its situation. However, especially for small and medium-sized enterprises that are not market leaders, it is extremely important to capture its suppliers' relationships. On the one hand for

pricing reasons, but on the other hand also to ensure that there are enough resources planned for the own orders and to secure a beneficial strategic negotiation position even without being the preferred customer (Pulles et al., 2016; Schiele et al., 2012).

Further conditions are the actors like strategic suppliers or complementors who are also competitors at the same time, as well as the part regarding its criticality and complexity. In contrast to parameters requiring a high need for transparency, a low part criticality (six votes) and a low part complexity (four votes) do not justify a high effort to search for information. According to the understanding of this World Café's participants, the part criticality signifies the percentage share of the part of the final product. Thus an A-part like the gearbox or the engine for vehicles endanger the shipment of the final product to the customer in contrast to attachment parts. The technical complexity of a part differentiates assemblies from simple or standard parts.

Apart from these static conditions, also dynamic factors play an important role for a high need of supplier relationship knowledge. Changes can concern the disruption risk which increases (Norrman & Jansson, 2004) or the supplier performance which decreases. Both changes are classified as threatening by the purchasers, as the supply risk on the top rank achieves eighteen points and the decreasing supplier performance still achieves twelve points (see figure 7). According to the purchaser discussions, a high supply risk can be suspected if parts are tool-specific, in case of a supplier insolvency or due to changes in the supplying company's property.

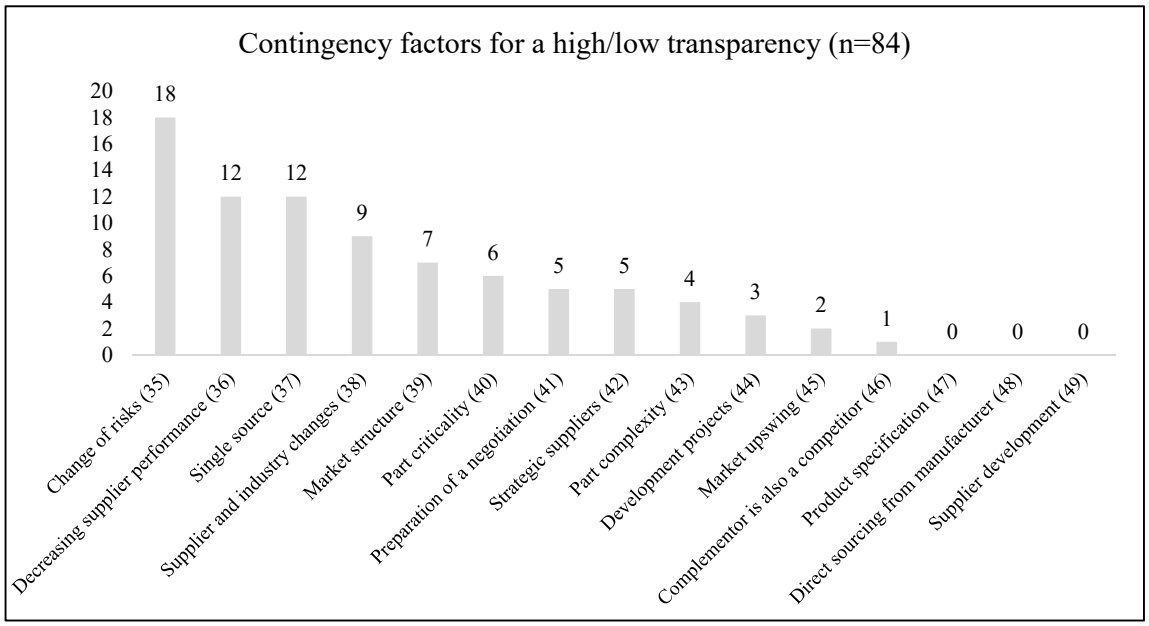

Figure 7: Rating of contingency factors

Apart from risk changes, there are also changes in the market like an upswing or significant changes for the suppliers or even the whole industry. Such trends include e-mobility drive technology, the signature of a contract to extend a business relationship or a change in the supplier's strategy and still achieve nine points by the purchasers during the World Café.

Particular occasions lead to a high need for transparency, as well. Quite often the purchasers have to prepare a negotiation, want to source directly from the manufacturer of a part or need to specify the product before its launch. Apart from these single activities, a high supplier relationship transparency also makes sense in regular innovation and supplier development projects, as this partnership is based on mutual trust.

CONCLUSION AND FUTURE RESEARCH

Contributions

Strategic purchasers of a focal company should know how their suppliers are related to their competitors and complementors. For this purpose, 14 purchasers were asked to participate in a World Café. Their answers have been clustered according to the Gioia Method.

This research leads to the following main theoretical contributions:

This article explains which knowledge purchasers should have about the relationships of their suppliers with other customers. It investigates when and how purchasers can find out how their suppliers work together with other customers. Consequently, this transparency contributes to the assessment of customer attractiveness, supplier satisfaction and the preferred customer status. In particular, this research investigates the different dimensions of customer attractiveness and supplier satisfaction. By increasing the robustness of these dimensions, purchasers are enable to better assess their own customer attractiveness. An increased attractiveness better matches the suppliers' expectations and increases their satisfaction. A standardised procedure to gather information enables companies to react faster. They can assess their status as perceived by the suppliers and in a next step actively influence it to become a preferred customer. This contributes to the literature on the benefits of preferential treatment.

The current literature on supply chain mapping presents the supply chain maps as an output, but neglects the procedure how to create them. This research contributes to the procedure of supply chain mapping. It examines the information gathering phase, which is an initial step before anything can be mapped. It suggests which information should be collected and where it can be found. Furthermore, the current literature focuses on the mapping of vertical supply chains. This article investigates the horizontal mapping of supplier relationships with competitors and complementors. The authors explain when it is important to know and map these relationships. Combining both directions enables the mapping of complex supply networks. While most supply chain mapping literature focuses on the mapping of nodes, this article proposes characteristics of supply chain linkages that should be examined. It also gives ideas how these connections can be quantified. This differentiates the current research from a pure market research on suppliers.

Moreover, this research also contributes to the work of strategic purchasers. The most important practical contributions are:

Strategic purchasers now have a checklist of the most important information that they should collect for a successful supplier relationship management. This information covers knowledge about the suppliers themselves, the business of their suppliers with other customers, and the collaboration between both parties. They profit from a collection of published and unpublished information sources that they can use to gather the desired information. Among the sample of 14 purchasers, they even know which sources these buyers regards as most helpful.

The purchasers know in which general situations and particular occasions this knowledge is important. Moreover, they can create an early-alert-system of severe changes that require a sudden increase of supplier relationship transparency.

Finally, the new knowledge can help purchasers to check and revise their supplier strategies. A well suitable supplier relationship management can again lead to a competitive advantage compared to other customers who do not have as much transparency about the relationships of their suppliers as the focal company. It helps the purchasers to assess their own customer status and to eventually switch it from a neglected to a preferred status.

Limitations and further research

The World Café has been applied in an agricultural machinery company. A generalizability of the results to other industries can be assumed, but requires a subsequent cross-sectional study across e.g. the automotive, electronics, food, construction and textile industry. Such an extension of the single case research design would certainly lead to additions regarding the required information or potential information sources and might lead to further, sector-specific contingency factors concerning the need of transparency on the supplier relationships.

Moreover, all participants in the World Café have come from the purchasing department. However, there are far more services in a company that are in a strategic collaboration with suppliers such as the research and development, material planning or product management department. The opinions of these departments on the required information about suppliers' relationships might lead to helpful additional aspects.

Even if the participants of this World Café have been purchasers with different portfolios, not all product-related commodities of the company have been represented. Maybe additional interviews with the purchasers of the remaining commodities might lead to further required information, information sources and contingency factors for the need of transparency.

Furthermore, a follow-up study with a larger sample of purchasers from different industries should follow to make the evidence generated from this research stronger and more reliable. This study should additionally explore the impact of supplier relationship knowledge on the purchasing performance. This paper has figured out which information is desirable, how it can be gathered and when it is needed. Based on these findings, it is important to further examine which activities purchasers carry out if they have this transparency and how successful they are with these activities. These results will create an additional contribution to decision-making literature. Purchasers should be able to learn from this additional study which information and which transparency-based actions will improve their purchasing performance under which circumstances.

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GLOSSARY

(1)	*Prices and margins*	The prices and margins of the supplier achieve 15 votes. This is a cumulated value: 14 points refer to the pricing of identical or similar products towards other customers, while one point is granted to the pricing of the whole supplier portfolio.
(2)	*Delivered competitor plants*	To which plants of the competitor does the supplier deliver his goods? Do the supplier and the competitor go "local-for-local"? This means that the production processes of the supplier are transferred to another country, e.g. a low cost country, if the competitor opens a new plant there.

(3)	*Aftermarket deliveries*	Does the supplier deliver the aftermarket of the competitor directly?
(4)	*Turnover share and development*	How high is the share of the focal company's turnover at the supplier and how has it developed during the last years?
(5)	*Shareholdings and joint ventures*	Does a competitor own shares of the focal company's supplier or even has a joint venture with him? Especially shares of a low percentage are very interesting to find out for the purchasers, as they are not as known as joint ventures, which appear in public media.
(6)	*Contact Person and meetings*	Do the purchaser of the focal company and the purchaser of the competitor have a contact person on the same hierarchy level at the supplier? Do they maybe even share the same contact person? This would be a very difficult situation regarding the exchange of confidential information. Does the competitor achieve management attention from the supplier; is he invited to VIP-meetings? Are there any private relationships on top management-level between both companies? Such close relationships that have existed for years would be very hard to break up.
(7)	*Contracts and agreements*	Not only contracts between the competitor and his suppliers are interesting for the focal company, but also any other kind of agreements, such as logistics and tooling agreements. How are the payment terms and how is the transfer of risk fixed in the incoterms? Is there a forecast for the needs of the competitor?
(8)	*Cooperation strategy*	If a supplier is a cooperation partner, the company exchanges information with him on important topics, such as business strategies or marketing activities, on management level. This cooperation sometimes already has a long history. It is helpful to know this history and the roots of a cooperation. In some cases, the cooperation between a competitor and his suppliers is fixed within a strategic cooperation agreement, which expresses the high mutual importance of the partners. Such agreements may decide, for instance, that referent engineers of the supplier are sent to the customer for a certain period of time in order to push common development projects.
(9)	*Dependency*	Does the competitor have alternative suppliers? A first approach to figure out the answer is to ask the supplier "Who are your competitors?" Each important competitor of the supplier might be a potential alternative supplier to the focal company's competitor.
(10)	*Supplier classification*	Concerning the supplier classification, the participants of the World Café are used to work with an ABCD-classification: A-suppliers are strategic partners and B-suppliers are alternative suppliers to them. C-suppliers describe developing suppliers, while D-suppliers will be phased out after the end of the ongoing project and will currently not get any future business.

(11)	*Supplier evaluation*	The supplier evaluation assesses the performance of a supplier at his customer. Does he show a comparable performance for the competitor as he does for the focal company? Evaluated parameters include among others the supplier reliability, e.g. measured by the ppm-rate, any awards as well as audit results.
(12)	*Technology exclusivity agreements*	If a supplier has an exclusivity agreement for new technologies with one customer, he always has to present his innovation to this customer first.
(13)	*Delivery scope*	Which products does the supplier deliver to the competitor? Are these identical or just similar products?
(14)	*Development projects*	Do the supplier and the competitor have common development projects with HR exchange meaning that the supplier's referent engineer works in the competitor's facility to exchange with his engineers? Who applies for a patent for this development and owns the rights for it - the competitor, the supplier or both?
(15)	*Open-book for the competitor*	Is the supplier willing to provide an open-book calculation to the focal company's competitors? The supplier's willingness to this open communication culture is usually influenced by the relevant customer's market power. However, if a purchaser knows that the supplier refuses an open-book policy to him but practices it with his competitors, he can confront the supplier with this fact and insist on it before signing a deal.
(16)	*Targets for the supplier*	Companies often measure their suppliers by targets without knowing how challenging these targets are in comparison to goals set by other customers. Consequently, it would be interesting to figure out their goals. If the competitors are less demanding regarding the ppm-rate, for example, the focal company might be able to realize higher sales prices as their purchased quality is better. The mentioned targets also involve the reactivity of the supplier to realize more or less volume. It is important to consider the goals set in order to properly compare the supplier's performance result in the supplier evaluation between different customers.
(17)	*Award decision process*	How does the competitor assign a project to his suppliers? Which criteria does he take into consideration and how does he rate price, quality and time to make his decision?
(18)	*Process optimization*	Common process optimisations between the supplier and the competitor in order to decrease the products costs should also decrease the prices of the focal company for the identical products.
(19)	*Production processes*	Does the supplier provide a whole production line and a dedicated team for the competitor? This information can often be achieved during visits of the supplier's production, if the supplier marks the different areas of his production by the customer names.

(20)	*Innovations of the competitor*	Does the supplier offer his innovations with priority to the competitors? The decision which customer to prioritize might be influenced by the volume or the margin that the supplier hopes to realize with this dedicated customer.
(21)	*Logistic concepts*	The logistic concepts used by the supplier for the competitor give important details about their collaboration: Does the supplier use reusable packaging? Is the supplier able to manage the competitor's inventory (VMI)? Did he invest into a new consignment warehouse dedicated to the competitor?
*****	*Unknown suppliers*	Purchasers show an interest for supplier-complementor relationships to learn about new suppliers in the meaning of market research.
*****	*Supplier audit results*	A new supplier has to be audited before he can be released in a focal company. Sometimes he forwards the audit report of another comparable customer, e.g. a competitor or a complementor of the focal company, who has audited him before according to the same standards such as VDA 6.3. After a single case decision, this reference might avoid a new audit.
*****	*Supplier flexibility*	Purchasers are confronted with time pressure, as their sales representatives often have already communicated fix delivery dates to their end-customers. Therefore, the reactivity and flexibility of the supplier regarding his customers is very important. By knowing the flexibility of the supplier towards the complementors, the purchasers of the focal company wish to detect who is the preferred customer for the supplier.
(22)	*Factory visit supplier*	During a factory visit at the supplier, the purchasers shall pay special attention to the production line as well as to the shipping area inside the warehouse in order to find out: To which other customers does the supplier deliver? Labels, a customized packaging or a special container management for one customer might provide this information.
(23)	*Supplier*	The supplier sometimes mentions customers on reference lists on his website or in his company presentations. If not, the purchasers of the focal company can ask the supplier's backoffice staff who knows about delivery dates and quantities of deliveries to the competitor and who maybe has worked with both companies for years. Moreover, the supplier's sales representative might provide the desired information, as he wants to sell his products. Project leaders and engineers at the supplier are further potential contacts. More information about existing relationships can be found in supplier self-assessments with non-disclosure agreements, in which other supplied competitors are a mandatory information, as well as in audit reports by competitors, which are provided by the supplier.

(24)	*Exchange with colleagues*	Networking helps to achieve information, for example, from former employees, colleagues working at the competitors or the own engineers. Team meetings provide also an important platform to exchange with colleagues or rumours can circulate among colleagues in any other way.
(25)	*Competitor machine analysis*	A competitor machine analysis can provide the information which parts supplied by a shared supplier are mounted onto a competitor machine. Usually, either the competitor himself or an independent dealer publish this kind of analysis, or the focal company carries it out in the context of a technical benchmark.
(26)	*Internet*	In the Internet, suppliers publish reference lists containing the names of further customers; search engines display information on projects between different companies; dealer portals list supplier parts and link their original equipment manufacturer references; awards honour the successful cooperation between suppliers and their customers and supplier videos show customer machines working with their parts for marketing purposes.
(27)	*Fair visits*	Purchasers appreciate visiting fairs to examine the exhibition objects of their suppliers, competitors or complementors and to collect information material such as pictures and catalogues.
(28)	*Factory visit competitor*	A factory visit at the competitor would allow to analyse the competitor and to find out about his relationships to suppliers. However, to examine relationships in this direction is less common than a supplier visit on the opposite side.
(29)	*Specialized press*	Specialized press not only includes dedicated test reports and company magazines, but also product recalls appearing in other magazines. Moreover, annual reports indicate the supplier's turnover for each branch. If a purchaser reads in the report that his supplier makes 10 million € of turnover in the agricultural business but he knows that he only purchases 1 million € thereof, he can deduce that the remaining 9 million € must be distributed among others.
(30)	*External consultants*	External consultants provide specific knowledge, e.g. on a specific market like Russia. They might be able to name the top suppliers owing production facilities in Russia and in an ideal case also their turnover with certain customers.
(31)	*Market activities*	Market changes or activities by competitors, suppliers or sub-suppliers are usually reported in the press or presented at conferences.
(32)	*Associations*	Industry associations (e.g. the German associations VDA, VDI or BME) meet regularly on conferences to exchange across different companies about the order situation and similar issues.

(33)	*Espionage*	Espionage is an illegal way to achieve information, yet frequently practiced especially by hackers due to IT security lacks. However, it has also been proposed rather in the sense of observations: The forwarders of the focal company can observe how many loading meters of goods the other forwarders working for competitors or complementors charge at the same supplier.
(34)	*Software providers and industry*	Software providers like SAP or SupplyOn work for various companies and migrate their data. Therefore, they are able to quantify these companies‘ relationships.
*****	*Complementors*	Complementors can serve as an information source in various ways. The achieved twelve points are a cumulated value of eight points given to an organized exchange with complementors, four points granted to the proposal to ask complementors who are willing to provide information and three answers that refer to complementors but achieved zero points each: benchmarking with complementors regarding supplier evaluations, workshops with the complementors and sales statistics of the complementors.
*****	*Internet-based RfQ platforms*	The new RFQ tactic mentioned means an open RFQ process via internet platforms where everyone can see which supplier bids for which projects according to which product specification sheet.
*****	*Supplier self-assessment*	Supplier self-assessments provide information about the suppliers' customers as they contain confidentiality declarations.
*****	*New employees*	New employees who have worked before at suppliers or complementors can provide information. The idea is to implement a standardized process under the responsibility of the HR department, who automatically identify and interview these employees about their former employer's relationships.
*****	*Dealers and customers*	Dealers often offer end-products from a focal company and its complementors in their shops. Moreover, they have to purchase the spare parts for all end-products from the focal company and its complementors. Therefore, they see the branding on the parts and quite often know the suppliers who have manufactured these parts. Sometimes, an end-customer directly disassembles his machine and can also see and provide the same information.
(35)	*Change of risks*	A change of risk, e.g. the supply risk, triggers a high need for information about the supplier relationships. A high supply risk can be suspected if parts are tool-specific, in case of a supplier insolvency or due to changes in the supplying company's property.
(36)	*Decreasing supplier performance*	The performance of a supplier will decrease, for instance, if his products have quality problems. This trend will also result in a bad supplier evaluation. Customers should be aware of this negative trend in the performance.

(37)	*Single source*	Single sourcing increases the supply risk. In case of a disruption of the supplies, the customers of the supplier compete for the supplier's resources. Therefore, they better should know as concrete as possible which volumes the supplier delivers to which customers.
(38)	*Supplier and industry changes*	Supplier and industry changes can influence the need for transparency on the supply network. Such trends include e-mobility drive technology, the signature of a contract to extend a business relationship or a change in the supplier's strategy.
(39)	*Market structure*	Does the market structure show a monopoly or an oligopoly? If the focal company is a monopolist, it does not have to bother about relationships that might potentially improve or endanger its situation. However, especially for small and medium-sized enterprises that are not market leaders, it is extremely important to capture its suppliers' relationships. The market structure requires a high transparency if there are only a few suppliers.
(40)	*Part criticality*	The part criticality signifies the percentage share of the part of the final product. Thus, an A-part like the gearbox or the engine for vehicles endangers the shipment of the final product to the customer in contrast to attachment parts.
(41)	*Preparation of a negotiation*	If a supplier asks for a price increase, a high transparency on his relationships is required. During the preparation of the corresponding negotiation, the purchaser of the focal company should figure out: How many options does the supplier have? Does he deliver other customers or industries, as well?
(42)	*Strategic suppliers*	It makes a difference, if a supplier is selected only for a single project, or if he gets a long-term or even a lifetime contract and hence becomes a strategic supplier. If the purchaser of the focal company knows that such a contract exists for A-parts between one supplier and the competitor of the focal company, this might be a reason not to assign a new project to him. Moreover, during the acquisition phase of a strategic supplier or the beginning of a joint venture with him, the purchaser should try to find out as much information about his relationships as possible.
(43)	*Part complexity*	The technical complexity of a part differentiates assemblies from standard parts. A high transparency is needed for the suppliers of complex assemblies, while a low transparency is sufficient for the suppliers of standard parts.
(44)	*Development projects*	Development projects in which both parties commonly work on high-level technologies, innovations and patents cause a high need for transparency.

(45)	*Market upswing*	If there is a boom in the market, the companies would like to know, if the supplier has enough capacity to fulfil the orders of all customers. If not: Who is the preferred customer of the supplier?
(46)	*Complementor = competitor*	The complementor of a focal company can get into a competing position if he starts to sell his complementary products directly to end-customers although the focal company sells these products to them.
(47)	*Product specification*	After the phase of product specification, the purchaser achieves his budget to source this part. In order to benchmark this target price and to get a better feeling for the supplier's manufacturing costs, he tries to find out: Which product delivered by which manufacturer at which price does the competitor use? This gives an indication if the own company is in line with the competitor's specification or if it has over- or underspecified the said part.
(48)	*Direct sourcing from manufacturer*	Parts that have been purchased from dealers, complementors or component suppliers before are relocated to their real manufacturers in order to reduce margin levels and to save purchasing costs. A high transparency is necessary regarding potential exclusivity agreements between the manufacturer and the previous supplier of the parts.
(49)	*Supplier development*	Supplier development projects are run only with a few selected first-tier suppliers of the focal company. During such a project, the company matches its purchasing statistics with the data of the developing supplier to check how he manages his commodities, selects his suppliers, etc. (which consequently are the second-tier suppliers of the focal company). Such a project requires a high degree of effort and trust. Therefore, the purchaser wants to know first who the preferred customer of the developing supplier is. If this supplier also makes a huge business with the competitor of the focal company, he might not start the project as he does not want to exchange the relevant data.

Analysing government spend behaviour - end-of-year and end-of-contract purchasing patterns

Katri Kauppi; Assistant Professor; Aalto University School of Business; P.O. Box 21210, FI-00076 AALTO, Finland; katri.kauppi@aalto.fi; mobile: +358504017112
Olli Kauppi; D.Sc. Economics, Chief Economist, Finnish Competition and Consumer Authority, P. O. Box 5, FI-00531 Helsinki, Finland; olli.kauppi@kkv.fi; tel: +358295053394

Summary
The objective of this study is to understand government agency spending behaviour through quantitative econometric analysis of several years of unique framework agreement purchasing data from the Finnish government central procurement body. The focus is on understanding purchasing behaviour at contract and budgetary 'change points', i.e. whether systematic spending spikes favouring e.g. incumbent suppliers or product categories occur at end-of-year or at the end or beginning of a new framework agreement. Agency theory will be used to formulate hypotheses on spend behaviour. The results are expected to provide an improved understanding of purchasing behaviour and policy implications.

Keywords: public procurement, spend behaviour, econometric analysis, agency theory

Submission category: working paper

Introduction

Purchasing managers are increasingly using spend analysis, i.e. aggregating, cleansing and analyzing organizational spend to gain spend visibility, identify cost trends and savings opportunities, and increase process control (Angeles and Nath, 2007; Limberakis, 2012). Secondary data use is becoming increasingly relevant and important in purchasing research as well (Ellram and Tate, 2016). Supply chain journals are also calling for the use of longitudinal data instead of surveys (Guide and Ketokivi, 2015) to improve research rigour and relevance. The Finnish Government has an objective to strengthen knowledge-based decision-making and openness (Ministry of Finance, 2017). Utilizing the vast data assets of the public sector can improve decision making, ensure transparency and step up the activities of the administration (Ministry of Finance, 2017). The Finnish Government open purchasing data initiatives thus provide an excellent opportunity to conduct highly relevant and rigorous scientific research, which can provide managerial insights into purchasing behaviour and hence assist in better management of government spend in the future. Specifically, this research is designed to analyse government spend data to better understand underlying patterns in purchasing behaviour. Two particular types of purchasing behaviour, which have received scarce attention in past research, are the focus of this research. The first behaviour is a problem frequently noted to occur in government spending, but which has received little research attention, and has not been studied in the context of framework agreements previously: the tendency of government agencies to spend their remaining budget in a hurry and potentially wastefully at the end of a (fiscal) year (Douglas and Franklin, 2006; Liebman and Mahoney, 2017). The second behaviour relates to buyer preferences for incumbent suppliers, and whether such preferences concentrate purchases towards the end or beginning of a new framework agreement period. The research goal of the project is *to understand the end-of-year, end-of-contract and start-of-contract spend behavior and how it is related to characteristics of the purchases and the buyers*. The goals will be reached by analyzing data on the purchases of Finnish Government overall and via the central purchasing body framework agreements. Agency theory is our

underlying theoretical framework. We formulate hypotheses on end-of-year and end/start-of-contract government spending behavior and test these with government spend data.

Literature review and hypotheses development

End-of-year spending

Recently, economics literature has started to focus on a government spending issue termed as 'use it or lose it' (Brimberg and Hurley, 2015; Hurley; Brimberg and Fisher, 2014;). This phenomenon is related to the fact that in most public sector organizations, government funds are allocated for a fixed annual budget, which expires at the end of the (fiscal) year (Hurley et al., 2014; Liebman and Mahoney, 2017). Any unspent funds at the end of the year must be returned, and underspending may also lead to a reduced budget the following year (Douglas and Franklin, 2006; Liebman and Mahoney, 2017).Thus, even though public organisations may at the start of the year spend cautiously to ensure a buffer stock of funds is available for any unexpected expenditures, any funds remaining will be spent in a rush at the year's end (Liebman and Mahoney, 2017). This situation presents a classic example of goal incongruence between the principal (the government allocating funds) and the agent (the agency the funds are allocated to); the loss of unspent budget at the end of the year creates misleading incentives for the agent to rush to spend down balances in a way the principal would not desire (Douglas and Franklin, 2006). Therefore we assume an end-of-year spike in spending can be detected:

H1: Government agency spending in the last month of the year will be higher than spending per month on average

There are likely to be varying levels of end-of-year spending in different types of purchases, caused by differing levels of information asymmetry surrounding them. The public sector in general has been criticized for low visibility of spend (Lempinen and Karjalainen, 2010), and low visibility of spend can particularly cause information asymmetry to arise in (public) procurement (Kauppi and van Raaij, 2015). According to Kauppi and van Raaij (2015), it is often difficult in the public sector to verify whether those with ordering rights use the pre-negotiated framework agreements or not, and in general how much is spent on what items and on which suppliers. However, the spend that does fall under the centralized framework agreements is likely to be better visible to management, as the centralized framework agreements are often associated with more control and better information systems, i.e. less information asymmetry exists between the principal (the party negotiating the agreement) and the agents (those ordering via them) and the agents would likely also be aware of the better documentation of purchases via these centralized channels. Hence it can be expected that end-of-year spend is directed outside the centralized framework agreements to keep it less visible. We thus hypothesise the following.

H2a: Government agency end-of-year spending spikes will be higher for spend outside central framework agreements

Spending at end-of and start-of framework agreement periods

We can assume both goal incongruence and information asymmetry impacting government spend behavior, the former more at the end of a framework agreement period, and the latter more at the start of a framework agreement period.

Issues of goal incongruence are likely to impact spend patterns at the end of a framework agreement period, if preferred suppliers are not chosen to future agreements. Long-term buyer-

supplier relationships are posited to have many benefits, such as increased efficiency, flexibility, better access to scarce resources and advanced technology, improved performance and competitive advantage for the buying organization (Nyaga, Whipple and Lynch, 2010; Prajogo and Olhager, 2012). On a more operative level, long-term suppliers can also provide better service and assistance (Kauppi and van Raaij, 2015). Hence, prior supplier relationship may bias buyer's choice behavior (Bendoly, Donohue and Schultz, 2006). EU directives and national legislation however prevent long-term supplier relationships in the public sector as contracts have to be re-tendered every few years. This does not mean that personnel with ordering rights would not have their preferences and habits regarding which supplier to order from; an issue sometimes leading even to contract non-compliance (Karjalainen, Kemppainen and van Raaij, 2009; Karjalainen and van Raaij, 2011). If those ordering via the framework agreements have strong preferences for existing suppliers but the supplier does not win the right to participate in the next framework agreement, they may feel the agreement is not in line with their preferences even if it fulfills the purchasing preferences of the principal. Hence, buyers may inflate their ordering behavior at the end of the framework agreement period to secure goods and/or services from their preferred supplier for as long as possible. We thus hypothesise:

H2: At the end of a framework agreement period, a supplier that has not been selected to the next framework agreement will receive a spending spike.

Both issues of information asymmetry as well as status quo preference can impact spend behavior at the beginning of a new framework agreement period.

While agency theory typically refers to information asymmetry in terms of the agent having information the principal is not privy to (Eisenhardt, 1989), agency problems may arise from information asymmetry also in terms of the principal having information the agent does not know (Hendry, 2002 & 2005; Kauppi and van Raaij, 2015). This can cause increased spending with suppliers continuing over framework agreement periods compared to new suppliers entering the agreements; buyers may not know about the new suppliers immediately if the information is not widely and timely distributed in the governmental units. If employees are not aware of the contracted suppliers and ordering procedures (Karjalainen et al., 2009), it can cause them to favor suppliers that have been involved also in previous framework agreements over new ones recently selected to the contract. This can also be connected to the goal congruence and buyer preferences discussed in relation to the previous hypotheses.

In addition to information asymmetry, the status quo bias theory can also provide an explanation for users preferring suppliers transitioning from old contracts over new ones. Most decisions made have an option of doing nothing or maintaining the current decision (Samuelson and Zeckhouser, 1988). The status quo bias or effect states that humans have a tendency to stick to their previous decisions / alternatives, and this has been proven in decision-making experiments (Samuelson and Zeckhauser, 1988). Status quo bias is based on the view that an alternative's value is raised by choosing it, and this leads to bias towards that alternative in subsequent decisions (Samuelson and Zeckhauser, 1988). Overall the bias is noted as a consequence of three factors: 1) rational decision-making in relation to transition costs and uncertainty, 2) cognitive misperceptions and 3) psychological commitment due to sunk cost and regret avoidance (Samuelson and Zeckhauser, 1988).

This tendency has been noted as an obstacle for switching suppliers due to e.g. the current suppliers' performance being better known for the buyers and because of the investments already being made in the current relationship and in becoming familiar with the incumbent's product characteristics (Samuelson and Zeckhouser, 1988; Carter, Kaufmann and Michel, 2007; Wagner and Friedl, 2007). The buyer may also perceive transition costs to arise from switching to a new supplier (Samuelson and Zeckhouser, 1988). Status quo preference has

been noted in previous organizational purchasing literature (Karjalainen and van Raaij, 2011; Puto, Patton and King, 1985) e.g. in laboratory suppliers and hotel bookings (Kulp, Randall, Brandyberry and Potts, 2006) and in overall e-procurement adoption decisions (Arbin, 2008). For both the above discussed rationales, we thus hypothesise:

H3: At the start of a new framework agreement period, 'incumbent' suppliers included also in the previous framework agreement will be favored over new 'incoming' suppliers.

Data and Methodology

We employ a unique panel data set on Finnish government agencies' purchases through centralized government framework agreements tendered and managed by the central purchasing body of the Finnish government, Hansel Ltd. The data set contains information at individual government agency level on all government spending through the central purchasing body's framework agreements from July 2007 to August 2017. One observation in the data consists of the total purchases (in euros per month) of a single government agency related to a specific supply contract belonging to a given framework agreement. In total 384 framework agreements are included in the data set. The following purchase categories are included in the data: Vehicle services, Professional services, Personnel and Health services, Professional IT-services, IT-equipment, Data center equipment and services, Transportation and logistics services, Consumer products, Accommodation and meeting services, Travel services, Software, Financial services, Telecommunications, Office services, Facilities Management services and Security technology. For example for the year 2016, this means a total of 771 million € worth of purchases representing roughly a fifth of all government purchases in that year. We use Stata 15 software for the data analysis.

Detailed monthly-level data on spending and information on the starting and ending dates of the framework agreements allows us to estimate precisely the end-of-contract and end-of-year spending patterns in the data. We employ regression analysis methods to control for seasonal variation, macroeconomic trends and other factors that may also influence spending. This part of the research is still work in progress. We also document the end-of-year spending spike using a second panel data set, which contains transaction level information on all state spending for 2016 and 2017 (i.e. not limited to framework agreements), to draw comparisons between centrally organized procurement and overall government spend. This second data set applies a somewhat different categorisation to the one mentioned above (this can be seen in Figure 2 later).

Preliminary results

Figure 1 presents the distribution of all government procurement, including purchases made via the framework agreements, in 2016-2017.[1] On average, nearly 15 percent of annual purchases are made in December, with other months much closer to the 8.3% average monthly share implied by a uniform monthly distribution.

[1] We exclude energy-related products and services from the analysis. The reason for this is twofold. Firstly, energy demand is very seasonal. Demand in December is naturally very high in Finland due to the cold weather, and including energy purchases in the analysis would thus lead us to overestimate the size of the end-of-year pattern. Secondly, for accounting reasons, the spend on energy for both December and January is reported in December invoices, further leading to overestimation of the end-of-year pattern.

In Figure 2, we present December's share of total annual purchases for different product and service categories using the same data as for Figure 1. From Figure 2, however, we can see that in all categories, the purchases for December exceed the average of 8,3%. The share is particularly high in ICT-purchases (equipment, services and software), Professional and research services and Machinery, equipment and transportation equipment. Particularly the ICT equipment is an area, where one could assume updating of equipment to take place at the end of year to ensure budgets are spent, as individual purchases are often not of very high value and thus do not go through a long approval process.

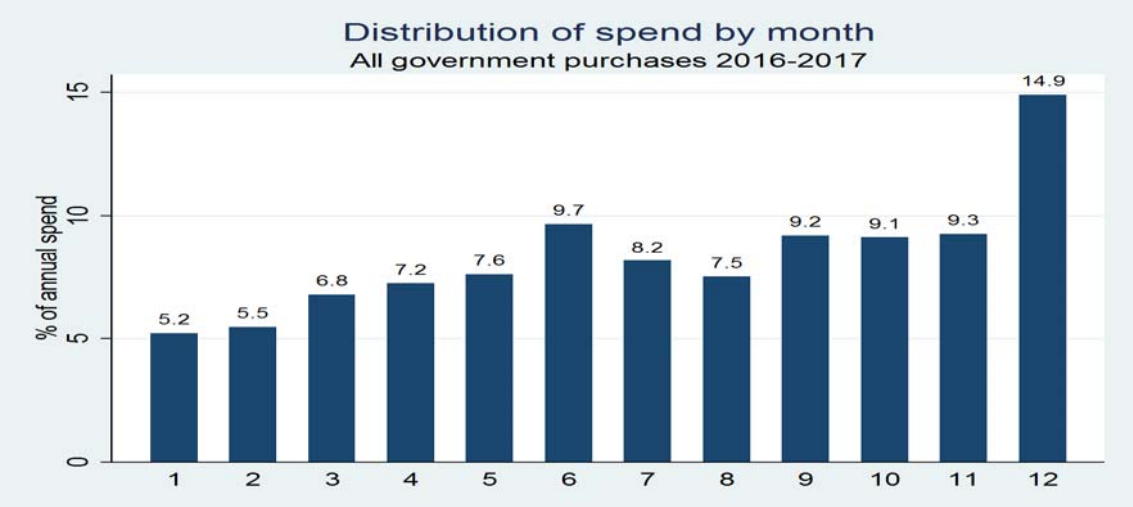

Figure 1 Distribution of spend by month for all government purchases 2016-2017

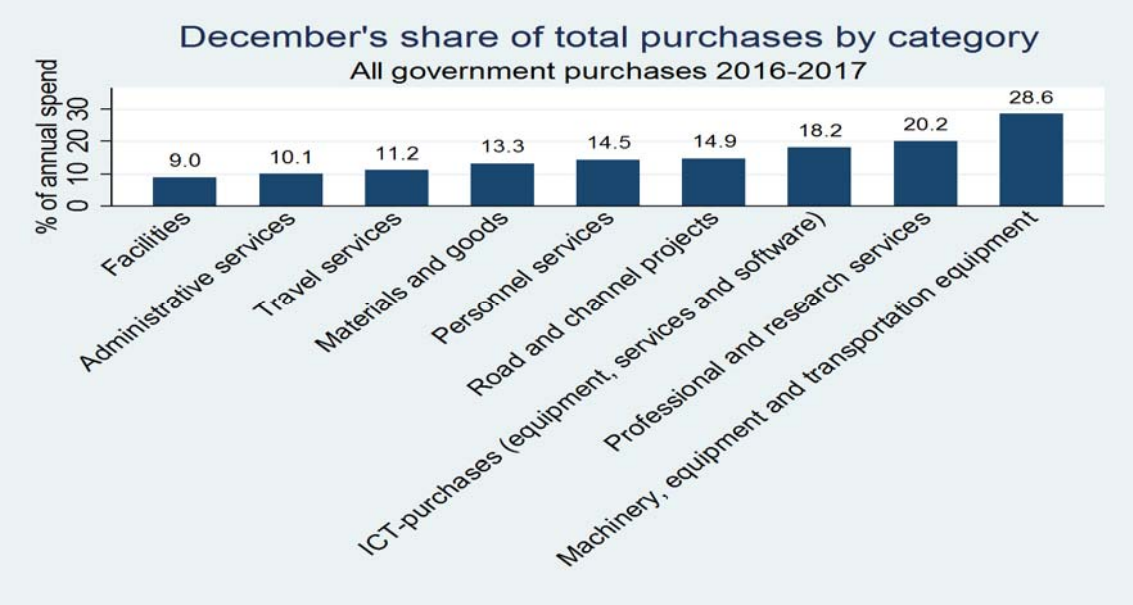

Figure 2 December's share of total purchases by category for 2016-2017

Figure 3 depicts the end-of-year pattern for different product categories using the framework agreement dataset from 2007-2016. Purchases are higher in December than on average for virtually all product categories. The highest category, accomodation and meeting services can be explained by the Christmas parties organised in each organisation typically in December (or

November), but again e.g. IT equipment is seen to have a high share of purchases in December, potentially for reasons of ensuring budgets are not cut in the following year. Overall, Figures 1-3 provide strong support for Hypothesis 1.

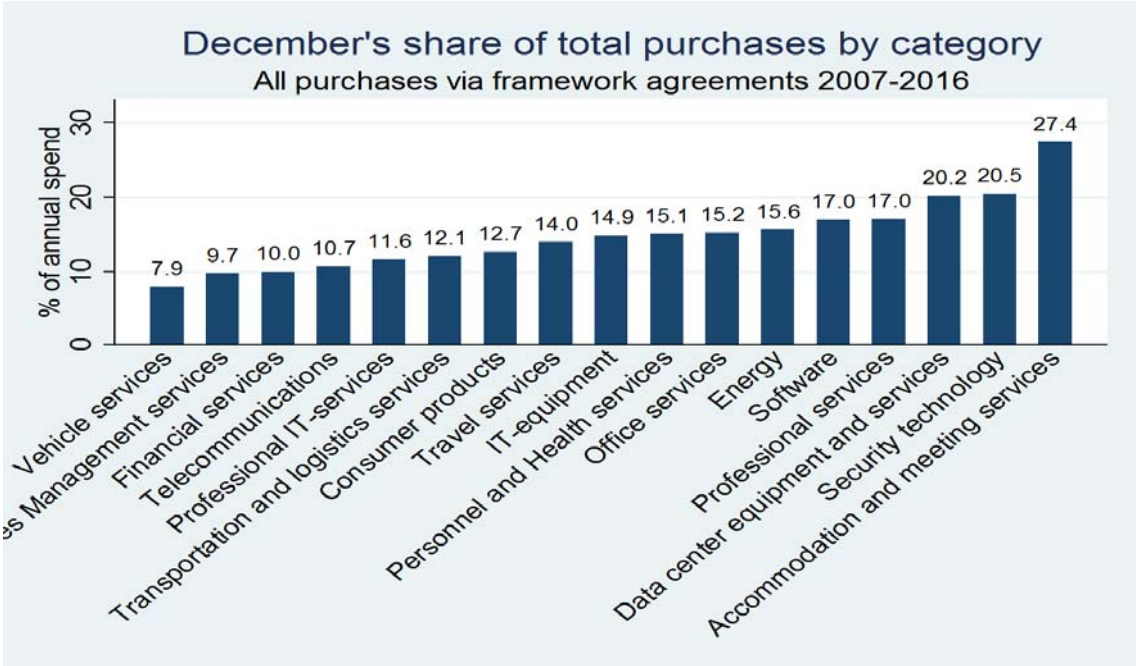

Figure 3 December's share of total purchases by category in framework agreements 2007-2016

Figure 4 compares the monthly distribution of purchases made via the framework agreements with other government procurement. To produce this graph, we combine the dataset on framework agreements with the dataset on total government procurement. The figure is based on data from 2016, the only year for which the two datasets overlap. To derive the distribution for the government purchases not made via the framework agreements, we simply deduct the purchases via the framework agreements from the figures on government total spend. As can be seen in Figure 3, the end-of-year pattern is much stronger for the government purchases not made via framework agreements. This supports Hypothesis 2. The spend via framework agreements is monitored more closely, as it is contractual spend and also reported by suppliers to the central procurement agency, thus end-of-year spend to simply spend budget would be more likely to be detected in these purchases.

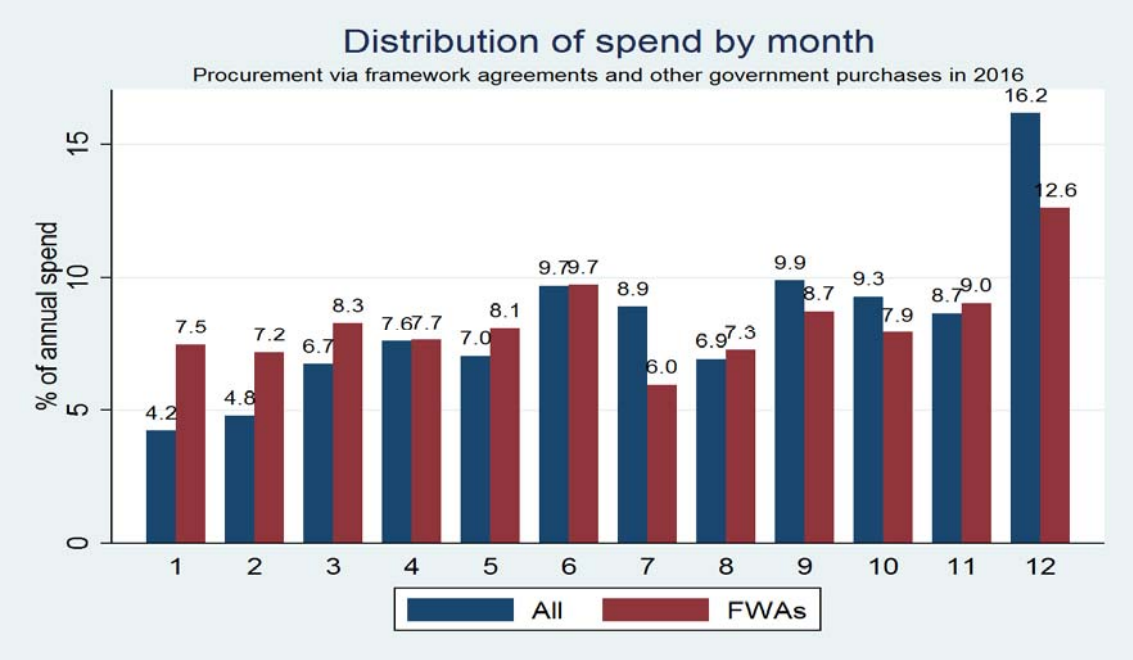

Figure 4 Distribution of spend per month comparing framework agreements with all other government purchases in 2016

Figure 5 illustrates the relationship between the end-of-year and end-of-contract patterns. We have limited the data underlying the graph to those framework agreements (2007-2016), where all purchases were made strictly within the starting and ending dates of the agreement (as within some of the framework agreements individual government agencies may have made contracts that exceed the general end-date by some months). In addition, we have limited the sample used for the graph to those framework agreements, the ending month of which was December. The monthly distribution of purchases is presented separately for the last year of the agreements and for the preceding years. As exhibited in the figure, the end-of-year spike in purchases is tempered in the final years of the framework agreements. In the final year of the agreement, December's mean share of annual purchases is 9.8 percent, whereas for earlier years it is 11.9 percent. Potentially the knowledge of a new contract with perhaps better terms serves to temper the end of year spike in spending.

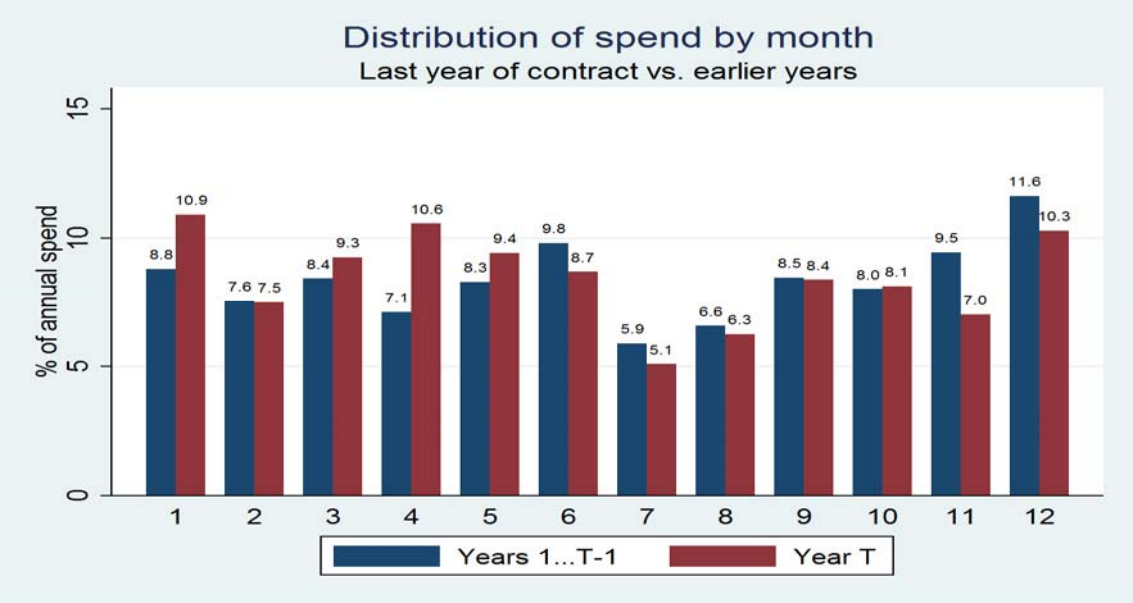

Figure 5 Distribution of spend by month to compare last year of contract spend

We are not yet able to present the results for testing Hypotheses 3. This testing requires significant manual work to match the contents of different framework agreements over the past 10 years to identify which agreement follows which one, and the work is currently ongoing. We hope to have preliminary results to present at the conference.

Discussion and expected contributions

As the research is work in progress, we only presented some preliminary results and related discussions. These results, however already provide strong support for Hypotheses 1 and 2, indicating that end-of-year spend is a significant phenomenon in government procurement, and particularly so in purchases where spend visibility is lower, i.e. supporting information asymmetry between the principal (the government) and the agent (the individual buyers) as an enabler of such spend behavior.

Overall, spend analysis is targeted at enhancing visibility, through which spend management and supplier performance can be improved (Limberakis, 2012). Data analysis with "big data" can lead to increased cost savings or improvements in procurement processes and/or overall system behaviour (Knight, Tate, Matopoulos, Meehan and Salmi, 2016). However, research on the behavioral, and potentially non-rational, aspects of purchasing has been scarce (Carter et al., 2007). Research on supplier switching is also scarce (Wagner and Friedl, 2007), as well as studies examining status quo bias in organizational purchasing. Partly these scarcities in past research have been due to lack of available data, as identifying patterns in spend behavior requires access to longitudinal purchasing data. Our unique longitudinal data on government purchases enables such identification, and later potentially improvements in government procurement based on our findings. Specifically, identifying spend patterns for end-of-year, end-of-contract and/or start-of-contract spend can provide important managerial insights in several areas. Identifying the existence (and magnitude) of potential end-of-year and end-of-contract spikes in spending (and the categories within which or the buyers by whom these appear) can 1) assist both buyers and suppliers in better forecasting spend and responding to it, 2) lead to "cost avoidance savings" in the future, if unnecessary end-of-year spend behavior can later be better controlled against. Critics of end-of year spend have noted it often results in wasteful spending on low-priority items (Douglas and Franklin, 2006), thus identifying and

eliminating it is of importance. Identifying potential supplier preferences in purchasing behavior at contract shifts and end-of-contract and start-of-contract spend can 1) assist both buyers and suppliers in better forecasting spend and responding to it, 2) provide insights to both buyers and incoming suppliers on how best to communicate and market new suppliers to ensure suppliers "transferring over from previous contract" are not over-favored over new suppliers. Overall, better understanding of spend behavior across categories can assist the buyer and the suppliers in future planning and control of government spend.

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Supply Chain Management in the Videogames Industry: a literature review and new research agenda

Stephen Kelly
Business School
Edge Hill University
St. Helens Road, Ormskirk, Lancashire, L39 4QP, UK
Tel: +44 (0)1695 654338
Email: stephen.kelly@edgehill.ac.uk

John Israilidis
Nottingham Business School
Nottingham Trent University
50 Shakespeare Street, Nottingham, NG1 4FQ, UK
Tel: +44 (0)115 8482673
Email: j.israilidis@ntu.ac.uk

Stuart Butler
School of Computing and Digital Technologies
Staffordshire University
Flaxman Building, College Road, Stoke-on-Trent, ST4 2DE, UK
Tel: +44 (0) 1785 353522
Email: n.s.butler@staffs.ac.uk

Neil Malone
Business School
Edge Hill University
St. Helens Road, Ormskirk, Lancashire, L39 4QP, UK
Tel: +44 (0)1695 657662
Email: malonen@edgehill.ac.uk

Abstract
The Video Games Industry (VGI) continues to grow dramatically. As industries mature, they rely more heavily on supply chain management (SCM) to ensure effective operations. SCM has been widely covered in many industrial areas and has more recently made forays into the service sector. Therefore, in line with other burgeoning sectors such as Tourism, there is now a heightened need to establish a structured approach to VGISCM research to meet the needs of practitioners. This paper contributes to the literature by developing existing VGISCM research by mapping, consolidating and evaluating the extant literature in order to demonstrate knowledge gaps for future investigation. Further, the work contributes to the wider literature on virtual supply chains by providing a more focused view of a specific industrial area and the drawing out of specific themes that are relevant.

Submission category: Working paper
Keywords/phrases: Supply chain; videogames; digital distribution.

Introduction

The overall aim of this paper is to start a research trajectory into the supply chains of the Video Games Industry (VGI) and establish what the extant literature area in the field of VGISCM has covered so far. The paper contributes to the literature by mapping, consolidating and evaluating this literature, to demonstrate knowledge gaps for future investigation. In addition, it serves as a "case" example of a specific industrial context for virtual supply chains in a more general sense. The work starts with a brief discussion of some key aspects of the VGI to set the context and the importance of the work. It then establishes the methodological approach to how the relevant literature was identified, selected and then analysed. The themes from this analysis are then discussed in more detail, before the elaboration of some implications for future research.

The Video Games Industry

A Brief History

Whilst some of the earliest video games originated in university laboratories earlier, it was arguably not until the late 1970s and early 1980s that typical consumers utilised home video game consoles and computers to play a variety of digital games. This preceded the 'videogame crash of 1983' (Cohen, 1984, Herz, 1997) that saw a downturn in the home videogame console market, generally believed to have been caused by poor quality titles and unsuccessful hardware launches. However, this also led to the significant development of the industry in Japan and a subsequent new generation of home videogame consoles. In tandem, home computers as videogame platforms remained commonplace and varied until the late 1990s which saw IBM PC clones become the dominant home computer platform (Farrimond, 2011a, 2011b). The late 1990s/early 2000s began to shape the industry into the form it is today, with Sony's PlayStation 2 gaining dominance prior to the launch of Microsoft's Xbox. From 2001 onwards, only Nintendo managed to continue to produce videogame console hardware to compete with Sony and Microsoft. During the subsequent 15 or so years, the continued iteration of Microsoft's, Sony's and Nintendo's products alongside the PC (and increasing home Internet availability), consumers gained greater access to content online. This content connected consumers to each other, but also to digital distribution platforms such as Steam, Xbox Live and PlayStation network – platforms that distribute products digitally, with no need for a boxed product.

The Importance of Video Games Industry Research

Whilst it is difficult to acquire precise figures, and consultancy organisations vary in their estimations, it is reasonable to assume that the value of the global videogames industry in 2017 is around US $74-$100 billion, as discussed by Kerr (2017: 32) in reviewing a variety of industry reports and consultancy sources. In addition, revenue is increasing and is greater than other entertainment industries. Mirroring a global trend, figures from the UK in 2014 demonstrated that VGI software sales alone were valued at £2.4bn, making it the biggest entertainment industry in the UK in terms of monetary value: more than film (£2.1bn) and significantly more than music (£1bn). Furthermore, and perhaps more importantly, whilst both music and film sales showed a decline year on year, digital games saw a 7.5% increase (Dring, 2015), mirroring similar findings by Kerr (2006: 49–50) comparing digital game sales to US box office revenues and recorded music sales. Whilst overall industry figures are significant, individual products compete with and often supersede revenue generation of other media. For example, 2013's highest grossing video game, Grand Theft Auto V, generated US$800 million in its first 24 hours (Goldfarb, 2013) and became the fastest entertainment property to gross US$1 billion (Pitcher, 2013).

Whilst academic interest in videogames has developed over the past 10-15 years, primarily due to the development of the field of Game Studies (Aarseth, 2001; Melcer 2015), this is not necessarily true of research concerned with the overall industry. Whilst sales have continued to increase over the past decade, academic research in this field has not paralleled this growth,

as Zackariasson & Wilson note, *"this industry has attracted surprisingly little attention from researchers of business and economics"* (2012; 1). What is clear, however, is the digital distribution and dispersed "product" development aspects of the industry mean that attention on the VGISCM is warranted. According to Sacco (2014), a significant growth in the adoption of digital distribution has been reported with 92% of PC video games sold globally via digital download. This has a direct and significant impact on the supply chain, primarily because the physical boxed product is eliminated and the reliance upon physical distribution and retail is reduced (see Figure 1 below for the traditional boxed product supply chain approach).

Supply chain management in the videogames industry

SCM overview

Definitions of SCM and its current use in different industrial fields. A rapid surge in SCM articles and books began to occur in the 1990s (Larson and Rogers, 1998). "Since its inception as a formal area of investigation in the mid-1980s, the conceptualization of the supply chain and SCM have evolved from a more narrow focus to one that today is broad and encompassing" (Stock et al., 2010: 33).

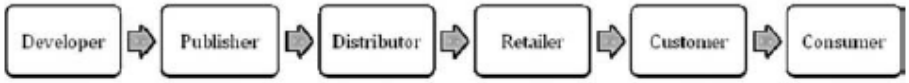
The traditional focus of SCM literature has been on manufacturing and production, where the physical flow of products can be tangibly seen as raw materials are converted into components that themselves go into larger pieces of equipment that are bought by distributors on a larger scale, before selling to a retailer who deal directly with customers. This view has been developed into service areas in which the tangible nature of supply is less clear. Similarly, largescale trends in SCM such as global outsourcing for labour and technological reasons has resulted in the development of a field of study in its own right (SCM, although this is a subfield of Operations Management). The benefits of taking a SC perspective of supply and demand are far-reaching and include, amongst others: ability to look at long term risks; consider supply chain structure and potential disintermediation.

Studies on SCM practices in different industrial sectors allow their special features to be distinguished to the applied practices, and improvement of SCM theories. These studies have been very valuable. To date, studied industrial sectors are, for example, pharmaceutical (Lurquin, 1996), automobile (Helper, 1991; Choi and Hong, 2002), apparel (Dapiran, 1992; Christopher and Peck, 1997), chemical (Vlasimsky, 2003), computer (Magretta, 1998), telecommunication (Reyes et al., 2000; Catalan and Kotzab, 2003), agriculture/food (Wilson, 1996; Cunningham, 2001) and grocery (Fernie, 1995; Zairi, 1998). Supply Chain Management has also been covered by Technovation journal, e.g. Aerospace – Berger et al., 2001; Kumer & Krob, 2005; and the special issue on Security in the Cyber Supply Chain in July 2014, but not in the Games Industry.

Concept of SCM in videogames – stages and organisations involved

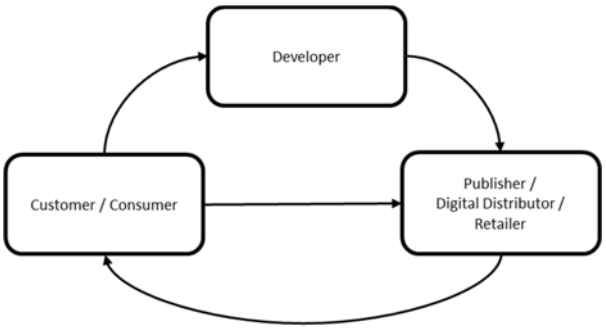
The traditional boxed product supply chain can be seen below in Figure 1. Whilst not atypical, this process makes it extremely difficult for small or independent developers to reach retail shelves without the backing of a major publisher - even if they fund their own project, they still need to find a publisher to manage distribution and retail. Although there is variation in estimates of the proportion of the sale that a developer receives from retail sales (and further study may provide a more accurate indication), many sources claim the publisher receives around 30-45% of the retail price (Yin-Poole, 2011, Good, 2015, Parfitt, 2015), which naturally means the developer receives even less, perhaps as low as 10% (Edwards, 2015).

Fig. 1 - Traditional value chain in the video game industry (Zackariasson & Wilson, 2012)



However, developments in VGI over the past 10-15 years have seen the proliferation of digital distribution. According to several sources (Yin-Poole, 2013, Francis and 2012, 2015, Parfitt, 2015), digital distribution, for example via the Internet platform *Steam*, is likely to return around 70% of the retail price to the developer - a significant difference to the traditional boxed product supply chain. Moreover, *Valve's* experiment in 2015 that allowed consumers to produce and sell their own content for developer created games (such as *Bethesda's Elder Scrolls V: Skyrim*) created a very different scenario which confers additional advantages to digital distribution for developers. Digital distribution therefore subverts the traditional supply chain and the lines between developer, publisher, retailer and consumer are blurred, often forming an iterative cycle as depicted in Figure 2.

Fig.2 - The iterative, digitally distributed supply chain (authors)



Some key aspects of the developments in the VGISCM therefore provide the practical impetus for further research in the area:

- Significant growth in the adoption of digital distribution, by developers, publishers and consumers, exemplified by 92% of PC video games sold globally are via digital download (Sacco, 2014), mean that the reliance on a physical boxed product is eliminated and the reliance upon physical distribution and retail is eliminated.
- Digital distribution platforms such as Apple's App Store and Valve's Steam (and to a lesser degree, console platforms such as Xbox Live Creators Program) enable a developer to self-publish, without the traditional need for a publishing house.
- Digital distribution offers greater market penetration, due to a changing market in terms of demographics, both from the perspective of changing attitudes towards VGI as a cultural industry but also due to the number of devices in the market that have access to digital distribution platforms for videogames by default (mobile phones, media set-top boxes ala Amazon Fire, games consoles etc).

Methodology

Scholars often question the validity and transparency of conducting literature reviews. To alleviate these concerns and conduct a rigorous and unbiased literature review, several approaches have had to be considered. A mixture of Tranfield's et al. (2003) 'systematic review' and Seuring & Gold's (2012) 'content analysis' was found to best fit with the research aims of this paper.

In detail, the first stages of the review included planning how materials would be collected and establishing the overall criteria and rules for inclusion and exclusion of studies. Specifically, the review was designed to include articles from the following six major databases: ABI/Inform Global, ScienceDirect, Scopus, Springer Link, Taylor & Francis and Web of Science. The keywords used were 'video games', 'video games industry', 'games industry', 'digital games', 'computer games' AND 'supply chain', 'Supply Chain Management', 'digital distribution', 'value chain', 'procurement' and 'purchasing' to ensure that a broad range of studies is captured. This also enables other scholars to fully appreciate the current breadth and depth of this area of VGISCM in an unfiltered manner, something which has not been previously conducted. To ensure a high quality output, only articles published in journals that are listed in the ABS 2015 Academic Journal Guide were selected.

This initial review resulted in the identification of sixteen papers and these were read by at least two of the researchers, to ensure inter-rater reliability. This resulted in the findings of Table 1 which shows the descriptive analysis as per the data extraction forms including information such as author(s); year of publication and context/keywords of study. Some of the analytic categories presented were derived from the research process model of Stuart et al. (2002), such as aim of research; method of data gathering and method of data analysis. In addition, the careful reading of the papers identified an additional three papers that were deemed relevant and these were added to the review process, totalling the number of reviewed papers to 19. This detailed analysis also provided us with a way of eliminating papers that would not contribute to a relevant thematic analysis, which is contained in Table 2. The development of themes was done inductively, allowing them to develop from the data.

Findings and Discussion

Table 1 shows the different papers that have been identified and the more descriptive aspects of them.

Table 1 – Descriptive analysis of papers reviewed

Author(s) and Year	**Keywords/Context of Study**	**Aims**	**Data capture/analysis**
Bryceson (2009)	Computer & Video Games; Agribusiness; Business Education; Supply Chain Management; Arts, Entertainment & Recreation	To introduce a prototype animated, interactive, three-dimensional virtual environment model of a supply chain in the agribusiness sector	Qualitative evaluation of model is undertaken.
Bhuiyan et al. (2015)	Computer Games; Experimental Design; Supply Chain Management Education	To explore the application of an interactive game/simulation in a supply chain context	Experimental study using Keller's ARCS model
Chiung-Lin Liu (2017)	Video Game-Based Learning; Experiential Learning; Simulation Games; Supply Chain Management; Logistics	To evaluate undergraduate students' opinions regarding supply chain and logistics management learning	Two questionnaires used to evaluate the students' perceptions
Marchand & Hennig-Thurau (2013)	Video Games; Entertainment Industry; Digital Distribution; Social Media	To pose the question as to whether flat-rate fee services are viable	The authors develop a conceptual framework of value creation

			through video games
Henfridsson & Holmström (2002)	Computer Games; Corporate Value Chain; Customer Involvement; E-Commerce; Online Entertainment; Systems Development	To explores the role of consumer participation in videogame development; how they produce knowledge, how it is exploited and how it is incorporated into packaged software	Interpretive case study of a computer game developer
Jöckel et al. (2008).	Value Chain; Computer & Video Games; Distribution ; Electronic Commerce; Experiment/Theoretical Treatment	To explore content creation and the opportunities offered by digital distribution, focusing on the prosumer – consumer created content as examined in relation to distribution, not development	Comparative case-study design
MacInnes et al (2005)	Digital Distribution; Software And Books Industries; Impediments	To explore elements that could hinder the digital distribution of books and software	Comparative case-study design
Teipen, C. (2008)	Labour Regulation; New Economy; Software Industry; Value Chain	To discuss VGI as part of 'Creative Industries' and investigate how VGIs can be more successful and expand to more markets	The empirical research is based on semi-structured interviews with industry experts and selected case studies
Wang, X., Jiang, L., & Shu, L. (2014)	Manufacturing and Logistics Industry, Fuzzy Cooperative Games, Improved Interval Shapley Value, AHP-GEM, Fuzzy Comprehensive Evaluation Method, Profit Allocation	To establish an indicator system and a new model for profit allocation in manufacturing and logistics industry alliance	Interval Shapley value method is applied and AHP-GEM method is incorporated.
Wilson, F. (2010)	Electronics Industry; Logistics; Sales Forecasting; Computer & Video Games	To generate forecast with a logistic model	N/A
Chandra, A.N. & Kurniawan, Y. (2015)	Entrepreneurs; Creative Industry; Interactive Games; ICT Strategy; Value Chain	To provide an overview to the games industry as a whole, particularly focussed on the potential of the industry in Indonesia	Qualitative analysis based on desk research and interview sources
Masur, S. (2006)	Value Chain; Technological Change; Software Industry; Payments; Games; Contracts; Advertising Campaigns; Licensed Products	To explore the development of games for mobile use, as opposed to games created for platforms like PCs or game consoles where users expect higher production values	N/A

Mai, E., Yang, J., & Chen, H. (2011)	Consumer Behaviour; Video Games; Internet; Online Video Game Industry; Complementary Products Retailing; Network Size; Customer Characteristics; Purchase Frequency	To explore the link between number of consumers who have adopted VGI products and sales of complementary products	A panel dataset was used to verify the proposed theoretical framework. Two-level hierarchical linear modelling was used to test several hypotheses
Chen, H. (2014)	Consumer Behaviour; Behavioural Psychology; Consumption Values	To empirically clarify the impact of product scarcity and uniqueness in buyers' purchase of games of limited-amount version	Data of 204 respondents were gathered using a survey method conducted and analysed with partial least square
Kim (2015)	Gamification; supply chain	Book on Gamification	N/A
Uijl, S., & De Vries, H. (2013)	Technological Change; Video Games; Consumers; Strategic Planning; Supply Chain Management; Digital Technology; Economics	A historic account of how Blu-Ray surpassed HD-DVD by building business networks, shifting allegiances and creating markets.	N/A
Sabet, E., Yazdani, N., & De Leeuw, S. (2017)	Supply Chain Management; Supply Chain Strategy; Supply Chain Integration; Agile Supply Chain; Fast Evolving Industries; Responsive Supply Chain	To define the “fast evolving industry” (FEI) and its SCM challenges	Uses a literature review to develop a conceptual model
Keskinocak, P., Xia, S., Janakiram, M., & Maku, T. (2011)	Supply Chain Management; Collaboration; Computer & Video Games; Colleges & Universities; Software Industry	To explore the application of an interactive game/simulation in a supply chain context	N/A
Broekhuizen, T.L.J., Lampel, J. and Rietveld, J. (2013)	Specialized Complementary Assets; Online Distribution Channels; Vertical Integration; Vertical Bypassing; Gatekeepers; Video Game Industry	To explore the two ‘views’ of video games distribution, i.e. that the emergence of online distribution allows content producers in the creative industries to bypass powerful publishers and distributors OR the view that this strategy cannot succeed without the complementary	Case study of the Dutch Video Game Developer (DVGD) bringing to market an identical game using two different but comparable

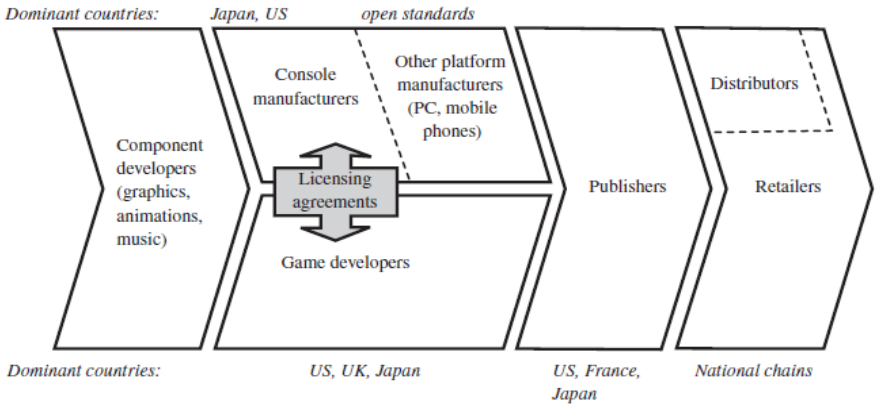
		assets that these intermediaries provide	distribution channels as a quasi-experiment

Table 2 shows the thematic analysis conducted, identifying key emerging themes in an inductive manner. Some papers were eliminated from the thematic analysis for the following reasons and these are useful to identify as they will provide guidance for future research in delimitating the boundaries of VGISCM and focusing their research more quickly and robustly.

- Those that looked at the application of an interactive game and/or simulation in a SCM context (e.g. Bryceson, 2009; Bhuiyan et al., 2015; Chiung-Lin Liu (2017; Keskinocak, et al., 2011) in that they are concerned with game based learning using specific contexts.
- Those that used the combination of words, but were not related to the concepts of VGI or SCM, for example Wang, X., Jiang, L., & Shu, L. (2014) which looked at the application of mathematical 'fuzzy cooperative games'.
- The search also picked up books (e.g. Kim, 2015) on topics such as gamification, which whilst of undoubted interest, did not demonstrate topical research in the area.

Table 2 – Thematic analysis of papers reviewed

Theme	**Discussion**
Change to purchasing behaviour	Influencing consumer behaviour by considering fees and publisher efforts to push from physical to digital to counter resale (e.g. Marchand & Hennig-Thurau, 2013) and ways of up-selling other products (e.g. Mai, E., Yang, J., & Chen, H. (2011), which look at initial positioning of primary products (e.g. Microsoft or Sony products) and then further sales of complementary products (e.g. purchasing Xbox360 or Wii afterwards). In addition, there is a consideration of macro-economic supply and demand factors, for example Chen (2014), which shows that product scarcity, an oft used marketing strategy, and shows that buyers bought games for perceived quality and uniqueness caused by scarcity and not assumed expensiveness.
Need for product development	Papers which provide an indication of some aspect of the product, e.g. sales of hardware (Wilson 2010) or the development of specific technologies (e.g. Uijl & De Vries, 2013).
Change of customer preferences	The key role of the prosumer in two aspects: (i) Customer influence on the development of products, specifically around how they produce knowledge, how it is exploited and how it is incorporated into packaged software (Henfridsson & Holmström, 2002) and the integration of user-made content (Jöckel et al., 2008). (ii) Customer influence on the development of distribution networks (e.g. Jöckel et al., 2008), which shows a move from the classic retail business of pre-packaged goods to a more knowledge-intensive, personalized distribution process.

Change of value creation	Value distribution and allocation in the supply chain (e.g. Chandra, & Kurniawan, 2015), which state that others will be more profitable than the "creator".
Need for localisation	A focus on specific geographical regions (e.g. Chandra, & Kurniawan, 2015), which focused on the Indonesian market.
Change to traditional supply chain structures	Supply chain structure (e.g. Masur, 2006), which shows that in certain cases, a single company might vertically integrate to act as a developer, publisher and aggregator, who acts as a retail-distributor in the sense that it provides one commercial outlet for several different publishers. In addition, there is work which identifies the role of disintermediation, in the transition from retail to Internet service provider or gaming (e.g. Jöckel et al., 2008) and those that posit benefits of different supply chain options. For example Broekhuizen (2013), identifies that the emergence of online distribution allows content producers in the creative industries to bypass powerful publishers and distributors or offering a counter view that this strategy cannot succeed without the complementary assets that these intermediaries provide. Finally, there is work, such as Teipen (2008), which sets out examples of VGISCMs (as shown in Figure 3 below).  ***Fig.3 - Graphical representation of a VGISCM (Teipen, 2008)***
Change of market size	The identification of barriers to the development and success of organisations within VGISCMs, such as being of a critical size (e.g. Teipen, 2008).
Change of market characteristics	Overall industry characteristics, specifically being categorised as a "fast evolving industry" (as per Sabet et al. 2017), which demonstrate high levels of innovation and differentiation, high-product/service variety and low-product/service life or replenishment cycles and increasingly sophisticated customers.

Although, it is not a content based theme, an area of note is the timing of research in the field is critical and that technological and consumer trends develop rapidly and more frequent research is needed. For example, the potential flat rate fees identified in Marchand & Hennig-Thurau (2013) are now a reality (e.g. as shown by Spotify) and this means that care needs to be exercised when making use of extant literature.

Conclusions & Contributions

This research has made a contribution to the games design field by offering the first systematic treatment of VGISCM. Further, it is hoped that this is the start of a research trajectory into VGISCM by the identification of specific thematic areas which gives an insight into the how digitally distributed supply chains differ from traditional models as well as the key priorities and drivers for VGI success.

Furthermore, one of the common assumptions associated with SCM is that an integrated supply chain will result in increased customer satisfaction, lower costs, and increased profitability for the supply chain as a whole (Amato-McCoy 2006; Chan et al. 2006; Harkins and Chin 1999; Yeung 2008). "This 'common sense' approach to SCM has been supported largely by anecdotal evidence provided in short case studies published in trade and professional journals. However, little empirical data beyond these case studies have been presented to substantiate those intuitive perceptions" (Stock et al. 2010: 37). This paper therefore provides additional evidence to support this debate and calls for more empirical research into the field of VGISCM to further understand the implications and opportunities provided by integrated and iterative supply chains.

It must be noted at this point that the relatively limited number of papers identified through this literature review, whilst highlighting research gaps, does suggest that a broader view of virtual supply chains is needed. This research, therefore, has provided a thematic basis and approach for this future work.

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The cost of corruption in the supply chain

Seongtae Kim*
Chair of Logistics Management
Department of Management, Technology, and Economics
Swiss Federal Institute of Technology Zurich
Weinbergstrasse 56/58, 8092 Zurich, Switzerland
Email: *seokim@ethz.ch*
Phone: +41 632 0733
Fax: +41 44 632 1526

Stephan M. Wagner
Chair of Logistics Management
Department of Management, Technology, and Economics
Swiss Federal Institute of Technology Zurich
Weinbergstrasse 56/58, 8092 Zurich, Switzerland
Email: *stwagner@ethz.ch*
Phone: +41 44 632 3259
Fax: +41 44 632 1526

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* Corresponding author

Summary

This study estimates the cost of corruption risk (CR) in the supply chain. Using an event study, we found significant market penalties for allegations of the firms' CR and its subsequent events. However, the market penalties were found to be driven mostly by initial events, but not by its subsequent events such as regulatory. Furthermore, albeit partially, this study revealed that the market reacts more negatively to CRs that occur upstream with suppliers than downstream with customers. Our regression analysis further suggested that there is no significant role as a remedy of firm accommodative response during the CR.

Keywords: Corruption, Supply chains, Event study

Submission category: Working paper

Introduction

Corruption risk (CR) has always been an issue in the global business. However, this topic is often neglected in the supply chain context. This apparent neglect is more surprising given that we are all now chronically aware of firms' corrupt behavior within a supply chain. As an example, consider the Apple's bribery issue – in 2010, a former sourcing manager was accused of receiving more than US $1 million in kickbacks from six suppliers in Asia (Kane, 2010). The then global sourcing manager pleaded guilty a few months later, agreeing to forfeit more than US $2 million. As another example, consider the Alcoa's scandal – in 2008, a Bahraini aluminum firm, known as Alba, accused Alcoa of a conspiracy involving overcharging (Simpson, 2008). According to bank records, Alcoa was found to steer payments for the material alumina more than US $2 billion over the last 15 years. Indeed, the CR should not be ignored in this field of research.

The lack of interest is more pronounced when compared to the area of general management research, where a CR seems to have been a major subject. Scholars in this field seem to pay much attention; for example, special calls by many outlets such as Academy of Management Review (Ashforth et al., 2008) can be viewed as its significant interest. This one-sided attention might be because CRs can often be regarded as a problem made by individuals and groups (i.e., "micro" view), or a problem beyond the unit level such as organization, industry and even country (i.e., "macro" view). As noted above, however, a large number of firms have been caught engaging in corrupt scandals, occurring up (i.e., toward suppliers) and down (i.e., toward customers) their supply chains. In this study, we aim to advance our understanding on this under-researched area by taking what we defined as a "chain" view of CRs (see Figure 1).

A CR is known to devastate the alleged firm's reputation (cf. Kroll, 2017). They also undermine the firm's supply chain, thus making business more costly. For example, a study by Arnold et al. (2012) argued that the damage by a CR causes the firm's financial loss of more than US $2 million in 2009. In the same year, a global survey of 729 senior executives found an average loss over the last three years associated with fraud, including corruption and bribery, of US $8.8 million (Kroll, 2017). A report by UNGC (2016) also revealed that the cost of a CR has been estimated at about US $2.6 trillion, which almost equates to over 5% of world GDP. These estimates would be good indicators for showing how detrimental a CR to the affected firm. However, their views are too micro or macro to define the true impact of a CR on the firm within a supply chain. This study attempts to overcome this limited aspect by estimating the shareholder value of target firms in the supply chain context.

In addition to the issue above, there is still a paucity of study with CR in the context of supply chain. One point is that a supply chain consists of firm activities connecting supply with demand or the opposite (Sellen and Soliman, 2002). Within a supply chain, CRs can thus occur in both directions (i.e., upstream- and downstream-facing CR). However, no supply chain studies we are aware of examine the impact of CR with this point of view. Another point of scarcity is that existing studies fail to reveal what increase the risk of corruption, and how the affected firms mitigate its consequences. This lack of research leads us to address the following research questions (RQs):

1. In the supply chain context, how does a CR affect firms' value, and how much?
2. How do upstream versus downstream CRs affect the firms' value differently?
3. What and how firm response strategy can mitigate the consequence of the CR?

This study takes a first step to examine what we term CR in the global supply chain context. Specifically, this study conducts an event study analysis to investigate how allegations of firms' CR and its subsequent events shape investors' responses. This study then examines the differential effects of a CR that occurs both upstream with suppliers (hereafter, "upstream CR") and downstream with customers (hereafter, "downstream CR"). To provide additional insights, we take a further look at firm response that might mitigate the consequences of a CR. In this study, we focus on firm's accommodative response, a strategy that could be a remedy during the CR scandal. Our results are based on a sample of 315 US publicly traded firms' CR events that were announced during 1984-2014.

By answering to the RQs, this study contributes to the literature in the following aspects. First, this study is a first effort to investigate the impact of corruption in the supply chain context. Few supply chain studies have been found examining corruption issues (e.g., Arnold et al., 2012). However, they are limited to the micro or macro view of CR, and do not provide the robust performance impact associated with CRs (for a review, see Kim et al., 2016). Second, the impact of a CR occurring up and down a supply chain is complex (Ashforth et al., 2008). In this study, we address this issue by integrating attribution (Weiner, 1985) and signaling (Spence, 1973) theories. This approach will help us to better explore the impact of complex phenomena associated with CRs within a supply chain (Wagner et al., 2011). Third, this study further extends the aforementioned framework by investigating how firm response is associated with the consequence of CR. We argue that the impact of CR can be attenuated by the affected firm's response strategy, something that has yet to be less explored in the literature.

Corruption in the supply chain

Typically, corruption involves two parties: provider (e.g., briber) and demander (e.g., bribee). Thus, a CR has a supply and demand side (i.e., wide view). Ashforth et al. (2008) noted that "the demand side focuses on corrupt institutions and officials who, for instance, demand bribes or other accommodations to conduct business transactions, whereas the supply side focuses on those who respond to the demands and, thus, perpetuate a corrupt system." Extending this view of corruption, for our purpose, this study sets a target firm as the focal point in a supply chain, and then focuses on a CR occurring upstream with suppliers (i.e., upstream CR) and downstream with customers (i.e., downstream CR), as illustrated in Figure 1. In this study, we define this view as a chain view of CR, involving the supply- and demand-side of corruption that occurs both up and down the supply chain. The chain view thus shifts a focus of analysis from the typical angles, such as micro and macro, to CRs that occur within

the supply chain context.

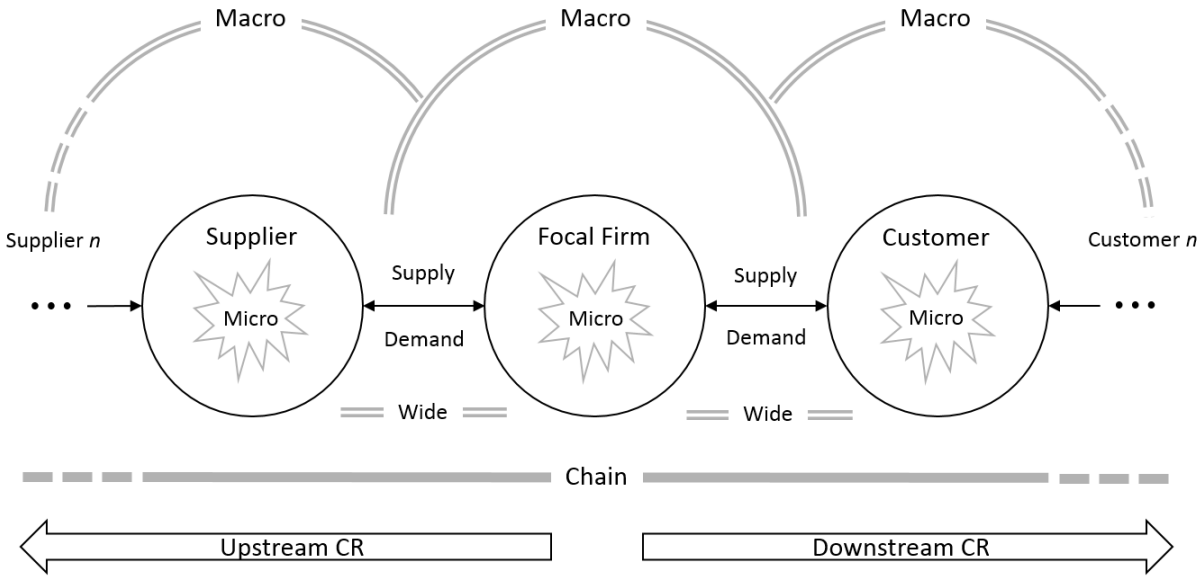

Figure 1 Chain view of CR occurring up and down a supply chain

Theory and hypotheses

In this study, multiple theories were considered to explain how a firm's misconduct regarding CR is punished by stock market. Specifically, by applying attribution (Weiner, 1985) and signaling (Spence, 2002) theories, we posit the following hypotheses: *H1. CRs will provoke a negative reaction by stock market in the target firm, H2. Upstream CRs will be penalized more by stock market then downstream CRs*, and *H3. During CRs, the market's negative reaction will be attenuated by the firm's accommodative response*.

Methodology

Data description

We compiled the data set of CR announcements via the ABI/INFORM Collection, a business database that contains the full text of the most widely read news publications. Following prior studies (e.g., Davidson et al., 1994), we chose the *Wall Street Journal* (WSJ) as our search source of CR events (1984-2014). The WSJ is the largest business newspaper in the US, which plays an influential role in shaping investors' perceptions. Our search terms consisted of combinations of the following CR-related key words such as buyer, supplier, contractor, vendor, supply, chain, bribe*, kickback, fraud, and corrupt*. We note that 1984 was chosen as the starting point because that was the first year WSJ news items regarding CR appeared.

We then read the full text of article to ensure that it was clearly about a firm's CR-related behavior. For a CR-related event to be included in our final data set, we used the following inclusion criteria: (1) alleged firms must be publicly traded on US exchanges including NYSE, AMEX and NASDAQ, (2) stock price data of the alleged firms must be available on the Center for Research in Security Prices (CRSP), and (3) the CR-related event must be

isolated from the effects of other financially relevant events such as earnings announcement. These criteria left us with a final sample of 315 CR-related events collected from 285 WSJ announcements.

In this study, building on Karpoff et al.'s (2008) typology, we categorize our sample into the following sequence of CR events: trigger, investigation, regulatory, and resolution. Here, a trigger event refers to the first disclosure of a potential CR, which include, for example, self-disclosures of misdeed and whistleblower charges. When a CR comes to the front, regulatory bodies perform informal inquiry or formal investigation. Following this investigation event, the regulators either drop the case or proceed with the investigation. We label this case as regulatory events. Finally, when the investigation is closed, a resolution event occurs. As indicated in Table 5, our sample involves 114 trigger, 29 investigation, 77 regulatory, and 30 resolution events. The other CR-related events, which are not categorized into any of the event types, were labelled in this study as "other".

Analysis of the data

This study estimates the cost of corruption (CRs) (H1) occurring up and down their supply chain (i.e., chain view) (H2). To this end, following prior studies, we apply an event study. This method is based on the principle of market efficiency, assuming that the investor's perception is immediately reflected in the stock price of a firm. It thus allows us to achieve our study aim by estimating changes in stock price associated with CR events (i.e., shareholder wealth effect of CRs). Many scholars argue that estimating stock prices or shareholder wealth is supposed to reflect the true value of firms (e.g., McWilliams and Siegel, 1997), which is what we also pursue in this study.

Shareholder wealth is typically measured by estimating an abnormal return (AR) associated with an event. Following prior studies (e.g., Brown and Warner, 1985), we estimate the AR using the market model:

$$AR_{it} = R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{mt}\right),$$

where R_{it} is the return on the stock of firm *i* on day t, R_{mt} is the return of the market index, S&P 500, on day *t*, $\hat{\alpha}_i$ and $\hat{\beta}_i$, are estimated using ordinary least square regression over an estimation period of 200 trading days (i.e., –210 to –11). To capture the cumulative effect over the event window, we also calculate cumulative ARs (hereafter, CARs). For more details about its technical issues, we refer the interested readers to Brown and Warner (1985).

This study also aims to examine whether the negative market reaction to CR is attenuated by a firm's response strategy (H3). To achieve this, we estimate the following regression models in hierarchical order:

$$\mathrm{CAR}_{(-1,0)} = \beta_0 + \sum_{k=1}^{4} \beta_{1,k}\,\mathrm{Type}_{k,i} + \sum_{k=1}^{4} \beta_{2,k}\,\mathrm{Industry}_{k,i} + \beta_3 \mathrm{Size}_i + \beta_4 \mathrm{Prospect}_i + \beta_5 \mathrm{Performance}_i + \beta_6 \mathrm{Organization} + \varepsilon_i \quad (1)$$

$$\mathrm{CAR}_{(-1,0)} = \beta_0 + \sum_{k=1}^{4} \beta_{1,k}\,\mathrm{Type}_{k,i} + \sum_{k=1}^{4} \beta_{2,k}\,\mathrm{Industry}_{k,i} + \beta_3 \mathrm{Size}_i + \beta_4 \mathrm{Prospect}_i + \beta_5 \mathrm{Performance}_i + \beta_6 \mathrm{Organization} + \beta_7 \mathrm{Upstream}_i + \beta_8 \mathrm{Response}_i + \varepsilon_i \quad (2)$$

where '$\mathrm{CAR}_{(-1,\,0)}$' is the cumulative AR over the two-day event window. A number of control

variables were firstly entered as a block in Model 1, followed by main variables, the locus of CR (1 if the CR occurs in the upstream side) and firm response (1 if the event is firm response to CRs), in Model 2.

Results

As discussed earlier, we applied an event study to test H1 (negative market reaction to CRs). Consistent with prior studies, we found that, on average, a firm's CR triggers significant negative market reaction. As shown in Table 3, the mean CAR over the event window is –0.56%, which is statistically significant at the 0.1% level. The two-day median CAR is also negative (–0.29%) and highly significant. The mean and median CAR for all other intervals, which are often used in recent event studies, are small and only marginally significant. This finding confirms the assumption of what we use in this study that a firm's stock price reflects all currently available information (i.e., in this study, CR events) immediately. Taken together, this evidence provides strong support for H1.

Table 3 CAR for CRs and by its event-type

Event day [t]	Mean (%)		Median (%)		% Negative	
Day before [–1]	–0.17	(–1.62)	0.06	(–1.01)	49.52	(0.41)
Event day [0]	–0.39**	(–3.19)	–0.19**	(–2.98)	56.83*	(–2.18)
Day following [1]	0.13	(1.46)	0.14	(1.22)	47.94	(0.97)
Event window [–1, 0]	–0.56***	(–3.35)	–0.29**	(–2.83)	54.29	(–1.28)
Alternative: [–1, 1]	–0.43*	(–2.45)	–0.31*	(–2.51)	55.56^{+}	(–1.73)
Alternative: [0, 1]	–0.26^{+}	(–1.81)	–0.14^{+}	(–1.88)	54.29	(–1.28)

Notes: n = 315; t-statistics for means, Wilcoxon signed-rank Z-statistics for medians and generalized sign Z-statistics for % Negatives are shown in parentheses.
$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table 4 Robustness checks for CAR [–1, 0]

Alternative model	n	Mean (%)		Median (%)		% Negative	
Mean-adjusted	315	–0.44*	(–2.37)	–0.17	(–1.60)	52.06	(–0.81)
Market-adjusted	315	–0.51**	(–3.11)	–0.29**	(–2.86)	55.24^{+}	(–1.66)
FF three-factor	315	–0.54***	(–3.36)	–0.21**	(–2.73)	53.97	(–1.11)
FF four-factor	315	–0.53***	(–3.42)	–0.25**	(–2.81)	54.92	(–1.41)

Note: t-statistics for means, Wilcoxon signed-rank Z-statistics for medians and generalized sign Z-statistics for % Negatives are shown in parentheses.
$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

The above results are based on using the market model to estimate CARs, which is common practice in the literature. One may argue that our study results could be driven by the choice of the model (Brown and Warner, 1985). Scholars also argue that the results may be reflected by other factors such as size, book-to-market, and prior performance (cf. Carhart, 1997). To verify our results are robust, we thus re-estimate the CAR using mean-adjusted, market-adjusted, three-factor, and four-factor models. As shown in Table 4, our results are robust to alternative models.

To provide further insights into the market reaction associated with CRs, we estimate the CAR by categorizing the CR scandal into different types of events. Table 5 presents stock market reactions to each type of CRs. As expected, the stock market reacts most negatively to trigger (–0.90%) and investigation (–1.14%) events. However, the negative impact by investigations was found to be marginally significant ($p < 0.1$). Thus, the shareholder wealth impacts of CRs are driven by the WSJ announcement associated mostly with trigger or somewhat investigation events, but not actually by its subsequent events such as regulatory and resolution.

Table 5 CAR [–1, 0] by CR event-type

	n	Mean (%)		Median (%)		% Negative	
Trigger	114	–0.90**	(–3.04)	–0.42**	(–2.65)	61.40*	(–2.25)
Investigation	29	–1.14+	(–1.81)	–0.43+	(–1.68)	58.62	(–0.86)
Regulatory	77	–0.02	(–0.05)	0.14	(–0.10)	45.45	(0.93)
Resolution	30	–0.24	(–0.43)	0.56	(0.77)	36.67	(1.46)
Other	65	–0.48+	(–1.71)	–0.50+	(–1.87)	58.46	(–1.28)

Notes: *t*-statistics for means, Wilcoxon signed-rank Z-statistics for medians and generalized sign *Z*-statistics for % Negatives are shown in parentheses.
$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$.

Table 6 Differential effects (CAR –1, 0) of upstream versus downstream CRs (%)

	Upstream			Downstream			Difference	
	n	Mean	Median	*n*	Mean	Median	Mean	Median
All events	69	–1.04*	–0.64*	246	–0.42*	–0.24*	–0.62	–0.40
Trigger	33	–1.98**	–1.46**	81	–0.46	–0.28	–1.52*	–1.18*
Investigation	2	–4.14	–4.14	27	–0.92	–0.43	–3.22	–3.71
Regulatory	20	–0.04	–0.01	57	–0.01	0.17	–0.03	–0.18
Resolution	6	0.48	0.66	24	–0.42	0.56	0.90	0.10
Other	8	–0.02	0.30	57	–0.55*	–0.58*	0.56	0.88

Notes: *t*-statistics for means and its comparison, Wilcoxon signed-rank *Z*-statistics for medians, Mann-Whitney *Z*-statistics for median comparison and generalized sign *Z*-statistics for % negatives are shown in parentheses.
$^{*}p < 0.05$; $^{**}p < 0.01$.

This study is mainly capturing a short-run impact of CRs, which is estimated over a two-day event window. One can however argue that a CR within the supply chain may not be an "overnight issue", and thus could distort perception of the investors in a long-run way. To verify this issue, this study estimates CARs over the next 60 days (i.e., roughly a quarter) using Fama-French factor models. In our non-tabulated analysis, we only used the "trigger" events ($n = 114$), which reveal that the mean and median CARs over the post-announcement period are statistically insignificant. We also found in our sample that the average time required to end CR scandal (i.e., from trigger to resolution) is about two years. We thus re-estimated CARs over a longer period: 120, 250 and 500 trading days. As a result, no significant impacts were found for both mean and median CARs. This result provides evidence that the market is only sensitive to CRs around the event date, which is consistent with our findings shown in Table 5.

To test H2 (upstream CRs will be penalized more), we divide our sample based on its locus of CRs: upstream versus downstream. As indicated in Table 6, we estimate its differential

impacts: upstream CRs have a mean (median) CAR of –1.04% (–0.64%), while downstream CRs are associated with a mean (median) CAR of –0.42% (–0.24%). However, a t-test (Mann-Whitney Z-test) for the difference in the means (medians) of stock market reactions was found to be insignificant. To verify this result further, we re-estimate its differential impacts based on using the type of events. We found that investors' reactions to upstream versus downstream CRs are only statistically different in trigger CR events. No significant differences were found in other subsequent events of CR. This evidence provides a partial support for H2.

Table 7 Regression estimation of CAR [–1, 0]

Variable entered	Model 1: Controls		Model 2: Main effects	
Constant	–0.022	(–1.515)	–0.016	(–1.076)
Event-type dummies[a]				
Investigation	–0.008	(–0.133)	–0.028	(–0.450)
Regulatory	0.165*	(2.452)	0.155*	(2.315)
Resolution	0.080	(1.292)	0.072	(1.174)
Other	0.080	(1.180)	0.014	(0.173)
Industry dummies[b]				
Mining & construction	0.101	(1.452)	0.121+	(1.709)
Transportation & public utilities	0.072	(1.221)	0.077	(1.308)
Wholesale & retail	0.027	(0.440)	0.017	(0.277)
Services	0.006	(0.089)	–0.002	(–0.032)
Firm control variables				
Firm size	0.016	(0.256)	0.013	(0.214)
Prior performance	0.156*	(2.095)	0.171*	(2.259)
Growth prospect	–0.011	(–0.167)	–0.053	(–0.757)
Organization	0.093	(1.482)	0.039	(0.551)
Main variables				
Upstream CR			–0.121+	(–1.723)
Firm response			0.089	(1.285)
Observations	310		310	
F for the model	1.164		1.345	
R^2 (%)	4.49		6.00	
Adjusted R^2 (%)	0.63		1.54	

Note: Main table contains standardized coefficients; *t*-Statistics are shown in parentheses; referent categories are [a]trigger and [b]manufacturing.
+$p < 0.10$; *$p < 0.05$.

As a further check, we regress the two-day CAR on the locus of CR. The results are shown in Tables 7-8. As the result reveals, the impact of upstream (versus downstream) CR is only statistically significant in the trigger model (Model 1 in Table 8). For the whole sample and other types of CRs (i.e., investigation, regulatory, and resolution), its impact was found to be insignificant. This result ensures the robustness of our finding that trigger events are only significantly different in negative market reactions.

Next, we also perform a regression analysis to test H3 (the negative impact will be mitigated by firm response). Contrary to expectations, we found no statistically significant impact of firm (accommodating) response, as shown in Table 7 (largest VIF = 1.986). Earlier, we found

that there is a significant difference in market reactions between the loci of CRs, albeit only for trigger events. To make sure our regression results are not driven by this difference, we re-regress the two-day CAR on firm response using each data set. The results presented in Table 8 still show no significant impact of firm response in both upstream and downstream CRs. This evidence provides a warrant to reject H3.

Table 8 Regression estimation of CAR [–1, 0] for CR type and its locus

Variable entered	Model 1	Model 2	Model 3	Model 4
	Trigger	Investigation	Regulatory	Resolution
Constant	–0.022	0.021	0.015	0.004
	(–1.010)	(0.225)	(0.440)	(0.071)
Upstream CR	–0.237*	–0.602	–0.082	0.420
	(–2.122)	(–1.251)	(–0.554)	(1.487)
Industry dummies	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Observations	109	29	77	30
F for the model	2.711**	0.412	0.391	0.595
R^2 (%)	19.77	16.34	4.99	18.47
Adjusted R^2 (%)	12.48	–23.29	–7.77	–12.59

Note: Main table contains standardized coefficients; *t*-Statistics are shown in parentheses.
*$p < 0.05$; **$p < 0.01$.

Table 9 Regression estimation of CAR [–1, 0] for CR locus and firm response

Variable entered	Upstream CR		Downstream CR	
	Model 1	Model 2	Model 1	Model 2
Constant	–0.025	–0.044	–0.026	–0.027
	(–0.781)	(–1.281)	(–1.502)	(–1.489)
Firm response	0.215+	0.234	0.039	0.074
	(1.787)	(1.440)	(0.601)	(0.943)
Event dummies	No	Yes	No	Yes
Industry dummies	No	Yes	No	Yes
Firm controls	Yes	Yes	Yes	Yes
Observations	69	69	241	241
F for the model	1.735	1.299	0.664	0.885
R^2 (%)	12.10	23.49	1.39	4.82
Adjusted R^2 (%)	5.12	5.40	–0.71	–0.63

Note: Main table contains standardized coefficients; *t*-Statistics are shown in parentheses.
+$p < 0.10$.

Conclusion

CRs, such as bribery and kickbacks, have been a troubling issue for decades in the global business. Against this backdrop, many efforts have been made to fight corruption within and outside the firm boundary. Examples include individual firm's compliance programs, enforcement actions like the US Foreign Corrupt Practices Act, or multi-stakeholder

initiatives such as the United Nations Global Compact's 10th Principle. Despite such efforts, however, they have shown a limited success (Kroll, 2017). Although firm-, industry- and country-level initiatives are constantly being refined (cf. UNGC, 2016), CR still seems to have run rampant in the supply chain.

The aim of this study was to advance our understanding on this aspect of corruption within the supply chain context. Drawing from attribution and signaling theories, the findings of this study provide rigorous evidence on how detrimental CRs are in the supply chain (RQ1), how different the magnitude is between the loci of CR (RQ2), and how effective the firm response strategy is during the CR (RQ3). Corruption is something an important topic in the field of general management, but has been relatively neglected in that of supply chain research. As also discussed earlier, extant evidence on this aspect also seems to be too micro or macro to reveal a true impact of corruption. This study is one of the first effort to overcome this under-researched area by taking what we defined as a chain view of CR, a new perspective that has yet to be introduced in the field.

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The effects of Hydroponics on Logistics

Authors

Kinanlis, Panagiotis, Harokopio University, Eleftheriou Venizelou 70, Kallithea 17671, pkinanlis@hua.gr, tel: +306972273118, fax: +302109577050

Malindretos, George, Harokopio University, Eleftheriou Venizelou 70, Kallithea 17671, gmal@hua.gr , +302109549233, fax: +302109577050

Summary

Hydroponics have been evolving rapidly during the last decade making large projects both economically and environmentally sustainable. Hydroponics are now a viable option for soilless farming nearby or even within large metropolitan areas, altering the supply chain management options on harvested goods. This paper examines the potential of major hydroponics projects within large metropolitan areas and remote areas such as islands in scope of the opportunities that arise throughout the Supply Chain.

Keywords: Logistics, Hydroponics, Green Logistics

Submission Category: Working paper

Introduction

In Hydroponics systems, production takes place in nutrient solutions (water, fertilizers etc.), inside enclosed environments, designed to control conditions such as temperature, light, water and nutrition. So every factor effecting the plants is controlled with precision, standardizing the growth and minimizing the risks (viruses, weeds, extreme temperatures or rain / hail or natural disasters).

The major advantages of hydroponics could be summarized to the following: a) high crop yield, b) indifference to ambient temperatures and seasonality, c) minimal land use, d) efficient use of water and fertilizers (controlled at drop level), e) mechanization and disease control (Jensen, 1999).

Hydroponics today

Hydroponics is gaining strength in Canada, US, Europe (western mostly) and Japan. The implementation of hydroponics projects is capital intensive and involves high level technology, most of which derives from Japan and in most cases is adjusted or even evolved in other countries applying hydroponics, as not every system is cost effective in every location. In the United States, hydroponics are used mostly for garden type vegetables, such as tomatoes, cucumbers and lettuce and lately, for marihuana, since its legalization in certain states. In Europe and Japan, the above mentioned vegetables, plus peppers, eggplants, strawberries and herbs are grown in hydroponic systems for large scale commercial exploitation.

The rapid evolution and spread of LED lights, alternative energy sources and automation processes used throughout a hydroponics project have made those technologies cheaper, thus making hydroponics economically viable, by optimizing ROI (Return On Investment) and IRR (Internal Rate of Return).

Hydroponics effects on logistics in urban areas

In terms of logistics, the current paper examines the effects of large scale food production in urban areas and the factors that need to be met for benefit optimization. In a more general definition, adopted by the United Nations, urban agriculture is an industry that produces, processes and markets food, largely in response to the daily demand of consumers within a town, city, or metropolis, on land and water dispersed throughout urban and peri-urban areas (Smit, et al., 1996).

To get a glimpse of the urbanization status, 2007 was set as a landmark for the up rise of urbanization, as the ratio of people living in urban areas to the total population exceeded 50% for the first time in history. In many countries through Europe and Asia, this ratio is well above 70% (Kourtit, et al., 2012) generating the need for more and more solutions toward sustainability in order to prevent the urban areas from collapsing in terms of economic, environmental and social discomfort.

Two major benefits of urban agriculture are: a) optimal use of resources (minimum land, water and fertilizers use), b) reduced food miles, since food is produced nearby the urban centres where it is consumed (Specht, et al., 2014). Food miles reduction, eventually leads to reducing harmful environmental emissions and cost of transportation (Bosschaert, 2008). Furthermore, less energy is used for transport, cooling, storage, and packaging, strengthening the local food system enhancing climate change adaptation and mitigation for cities (De Zeeuw, 2011).

Another major advantage is the ability to rapidly alter the products produced, according to the trends of demand. The time advantage is twofold with hydroponics near or inside urban areas reducing the time needed to adjust the production and for the goods to be distributed to meet demand in metropolitan areas.

Hydroponics, one of the most sufficient methods for urban agriculture, have also been connected to the concept of smart cities. Cities aiming towards and designed for economic, social and environmental sustainability, covering all three major factors of sustainable development. Information and communication technologies (ICT) are crucial for developing smart cities, not as an end in itself, but by enhancing the above stated economic, social and environmental sustainability of the city. So, hydroponics systems which are more often than not based on ICT could act as best practice on the concept of smart cities. According to the EU policy, smart cities should mobilize knowledge centers (universities, R & D centers, innovative private companies etc.) and motivate them to collaborate into innovation hubs. Hubs are purposed to multiply the innovation outcome above and beyond the combined knowledge, due to the multiplier effect and most importantly to disseminate the knowledge outcome beyond the hub members. As far as demand is concerned, smart cities are associated with citizens highly informed as consumers, who would prefer pesticide-free and local produce, produced and delivered to them through a highly innovative supply chain (Santos, 2016).

Agrifood Hubs could act as more specialized innovation hubs for the agricultural sector, enhancing the smart cities priorities. In particular, the Agrifood Hubs (AH) have contested over the last decades within the academic and public institutions as main enabler of the economic, social and environmental sustainability of SMEs in the dominated surrounding conventional agrifood system in developing countries.

AH provide knowledge and information for potential markets throughout the world and value adding services, promoting collaborative action/synergies and enabling market thus access particularly for SMEs through integrating agrifood supply chains, bridging small producers and the consumers-individuals and families as well as big buyers (Ploeg, et al., 2012).

Hydroponics potential in Urban Centers

The research question of this paper is to what extent hydroponics could affect food logistics in urban areas such as the Region of Attica and if the conditions for implementing large-scale hydroponics projects are met or could be met in the near future. Likewise, for isolated areas, such as the Greek remote islands, especially in Cyclades and Dodecanese. The above will be examined by reviewing literature on the effects of hydroponics on food supply chains and best practices applied and comparing the suggested conditions to the current status in Attica. Factors such as current transport infrastructure, production volume, current farming and local demand appear to be to be crucial, as suggested by current literature on the subject, along with the share of highly educated people needed to perform knowledge-intensive jobs on large-scale hydroponics projects.

In terms of transport infrastructure, the region of Attica, is supported by the port of Piraeus, Athens International Airport Eleftherios Venizelos, a vast road network leading to Southern and Northern Greece and railroad network soon to be upgraded by foreign investors. The port of Piraeus was ranked 7th in 2016 in terms of TEU (Twenty-foot equivalent unit) transport among the European ports, with a 9,4% growth compared to its 2015 performance (Notteboom, 2016). Athens International Airport (initialized as AIA), is among the newest airports in Europe and ranked 29th busiest in Europe, with 21,736,466 passengers and 7,712,580 kg of cargo (freight and mail) during 2017 (AIA Statistics).

Image 1: Greek Highways (Official Government Gazette 253/21.12.2015 - www.et.gr)

Attica is connected to major cities through national roads, with Attiki Odos as crucial infrastructure crossing throughout the Region. Indicatively:

- Athens – Thessaloniki (E 75)
- Athens – Korinthos (E 94) and Korinthos – Patra (E 65)
- Korinthos – Tripoli – Kalamata (E 65)
- Patra – Pyrgos – Olympia (E 55)
- Thessaloniki – Kavala – Alexandroupoli (E 90)

Image 2:Railroad Map (www.ose.gr)

Likewise, the railroad map connects most of the country of Greece's mainland with Attica at its center. The railroad network connects Attica with regions of high quality and volume agricultural production such as Peloponesse (Korinthos, Parta, Tripoli, Kalamata), Sterea Ellada, Thessaly, Western and Central Macedonia (Kozani, Florina, Serres).

A safe holistic approach to implement successful large-scale urban agriculture is to address all four of the following priorities (Gooch, 2005; Lee, et al., 2015; Berti, et al., 2017): a) Logistics - Supply Chain Management, b) Production Management, c) ICT Support, d) Marketing and Commercialization. More specifically:

a) closed loop short supply chains should be carefully designed and implemented, with the integration of waste management and re-use, post-harvest logistics, sourcing design and analysis, flows and inventory management, food losses and operational efficiency, transport and distribution challenges, routing problem, integration of UF into the urban logistics organism (including passenger transport, utilities transport, private and public distribution networks, safety issues etc.)

b) production types should be designed according to needs per produce, Quality Standards Systems, growing techniques, water management and irrigation technologies, soil management, Life Cycle Assessment of products, Innovative production (e.g. urban aquaculture), vertical farming, living walls, green roofs, lean optimization of production

c) ICT includes traceability systems, Customer relationship management (CRM) systems, telematics and routing optimization systems (vital for urban distribution networks), SCM and Production monitoring systems, and Warehouse Management Systems (WMS)

d) last, but not least, marketing should handle retailers' view and acceptability, potential for contractual agriculture and vertical integration (leading to investments and economies of scale), consumers' acceptability, labelling and marketing of products.

Further research is needed to examine the current load and cost of transport (inbound and outbound) for Attica in order to access the potential benefits from implementing large scale urban farming projects. Both for meeting the current internal demand in Attica and in order to export to other regions and countries. Current data implies a sufficient ratio of highly educated personnel available in Attica in comparison to the rest of Greece (on average for the period 1995-2012: 23,65% of workforce in Attica holding a higher education degree - 12,60 for the rest of Greece), but there is no previous or current experience on urban farming in Attica, especially on a large scale, let alone connected to the concept of agrifood Hubs and smart cities.

Another critical factor is the ratio of acceptance of urban farming products, since in a country with significant agricultural heritage such as Greece, consumers seem to be wary of products based on non-traditional farming methods. A factor that might ease acceptance is the fact that consumers living in urban areas are more unaware of the food sources and methods applied.

Hydroponics effects on logistics in remote areas

As far as hydroponics projects on remote areas are concerned, the most extreme example would be the one concerning Antarctica. Hydroponics has proven to be the sole source of fresh vegetables during winter in Antarctica, justifying potential to provide in other hostile environments, such as lunar bases and space missions (Sadler, 1992). On a more daily-life example, an island could become less dependent on the mainland and avoid the transportation costs. Isolated areas, such as the Greek remote islands, especially in Cyclades and Dodecanese could benefit by implementing urban farming methods, such as hydroponics, aquaponics etc. Furthermore, certain installations could also provide significant amounts of fresh water (Wahlgren, 2008), a basic good currently in scarcity for most islands.

Further research is needed to examine the current load and cost of transport (inbound and outbound) for products traded from and to specific Greek islands, ideally using individual sets of data for low and high season in order to access the potential benefits from implementing large scale urban farming projects.

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ASSESING THE PERSONAL TRAITS AND SKILL REQUIRED FOR PURCHASING JOBS

Vojtěch Klézl[1], Jan Vašek[2], Miloš Kotrle[3], lecturer[1, 2]; research assistant[3]; VSB-Technical University of Ostrava[1, 2, 3]. Faculty of Economics; vojtech.klezl@vsb.cz[1]; jan.vasek.ekf@vsb.cz[2]; milos.kotrle.st@vsb.cz[3]. Sokolská třída 33; Ostrava, Czech Republic. +420 597 322 386[1]; +420 597 322 375[2]

Soroosh Saghiri; senior lecturer; Cranfield School of Management; s.saghiri@cranfield.ac.uk; College Road, Cranfield, UK.

Summary

Based on the thematic analysis of 432 job postings, this paper explores the desired purchasing professional skills and personality traits. We conclude that more complex skills are required with increasing buyer seniority. The desired buyer personality traits mix, on the other hand, remains stable across hierarchical levels and is dominated by the Conscientiousness characterised as independence, responsibility, compliance, and risk aversion. We argue that the observed personality traits mix suggests the prevailing transactional and support procurement role in companies.

Keywords: Purchasing skills; buyer personality traits.

Submission category: Working paper

Introduction

Industrial buyer role gains importance whilst becoming more challenging (Giunipero et al., 2006). Purchasing professionals are responsible for defining and implementing category strategy, managing supply risks, establishing long-term relationships, and leveraging innovation capabilities, while simultaneously assuring all operative tasks and striving to reduce costs (Feisel et al., 2011).

The extant literature establishes a hierarchy of buyer skills which evolve from simple procurement specific skills towards generic managerial skills (Giunipero, 2000). It suggests that purchasing managers should focus on six cumulative areas of expertise to fulfil the demanding and sometimes conflicting tasks: Technical (fundamental and basic administrative skills), Advanced procurement skills (category management, sophisticated procurement levers), Interpersonal (interaction with people in teams), Internal enterprise (market analysis and internal relationships), External enterprise (supplier relationship management), and Strategic business skills (broader strategic issues and risk management) (Tassabehji & Moorhouse, 2008). The literature also demonstrates that the skillset varies with seniority: an assistant buyer relies primarily on practical purchasing skills while a purchasing manager leverages management, information processing and communication skills (Mulder et al., 2005).

Yet, our literature review suggests that the impressive body of knowledge is based primarily on purchasing community inputs and self-reports, and may therefore potentially fall victim to the respondent bias. To gain confidence in extant literature conclusions and recommendations concerning the required buyer skills and their hierarchy, it is necessary to seek input from different informants such as top management, other functional department managers or human resources.

This paper is an attempt to provide such alternative perspective. We explore whether a different mix and more complex skills are required with increasing buyer seniority on a sample of 432 job adverts for four distinct purchasing hierarchical levels. Our empirical findings overwhelmingly corroborate previous literature conclusions. Additionally, our results suggest

that employers use the professional experience and the relevant industry experience as proxies for the required skill level.

However, the main contribution of this paper relates to the importance and mix of personality traits required from procurement professionals. Even though they were mentioned in more than 75 % of advertisements, they were not subject to extant supply chain research. We therefore adapted the widely used Big Five model of personality traits (Barrick & Mount, 1991) to shed light on what represents desirable procurement professional´s personality traits. Our results revealed a consensus concerning the required traits among employers as well as across hierarchical levels except for Conscientiousness which somewhat decreases with seniority. Consciousness represented by the autonomy, reliability, diligence, and consistency is the most valued personality trait followed by the stress resistance (Emotional stability), willingness to travel and open mindedness (Openness to experience), flexibility (Agreeableness), and proactivity (Extraversion). Such personality traits coherence and mix suggest that employers still view purchasing as a primarily transactional and operative activity.

The paper is organized as follows: we shortly review the extant literature on purchasing skills and complement it with the personality traits classification model. We then outline our methodological choices. The findings section first deals with buyer skills and competencies and then focuses on the required buyer personality traits. We conclude with opportunities for further research.

Literature review

A well-functioning purchasing department is critical for company's success (Carter, 1996). The dramatic evolution of procurement role from purchasing towards supply chain management (Kraljic, 1983) requires that the taken for granted buyer clerical and purchasing process related skills are complemented with strategic management competencies (Rodrigues, 2006). This trend was particularly pronounced in the last two decades: While buyers considered the decision making, influencing, persuasion and problem solving skills as key in 1992, the same survey highlighted the importance of 'supply chain management' and 'understanding business conditions' in 1999 (Giunipero, 2000). This section first outlines the main contributions concerning the procurement skills and competencies and then reviews the research related to buyer personality traits.

Purchasing skills and competencies

Purchasing skills and competencies can be divided into two basic groups (Kolchin & Guinipero, 1993): procurement specific and generic managerial. We apply this categorization to subsequent contributions summarized in Table I (see next page).

Scholars concur that different hierarchical levels require different skillsets (Giunipero, 2000; Mulder et al., 2005; Tassabehji & Moorhouse, 2008): Purchasing professionals first acquire the initial purchasing skills (Mulder et al., 2005) and leverage the interpersonal and negotiation skills (Giunipero, 2000; Tassabehji & Moorhouse, 2008) before moving on to the advanced procurement, decision-making, internal and external coordination skills (Giunipero, 2000; Tassabehji & Moorhouse, 2008), and finally master the management and strategic business skills (Mulder et al., 2005; Tassabehji & Moorhouse, 2008) in senior purchasing positions. Our literature review suggests that the skills evolution concept was substantiated primarily through purchasing professionals´ interviews and surveys and its validity was not tested through alternative respondents or data sources such as job descriptions, advertisements, observation or experiment.

Kolchin & Guinipero, 1993	**Procurement-specific skill groups**	**Generic (management) skill groups**
Giunipero, 2000	Strategic purchasing, Quantitative purchasing	Process management, Team, Decision-making, Behavioural, Negotiation skills
Carr & Smeltzer, 2000	Technical skills	Skills techniques, Behaviour Skills
Gammelgaard & Larson, 2001	Quantitative/ technological SCM core skills	Interpersonal/ managerial basic skills
Mulder et al., 2005	Practical purchasing Initial purchasing	Information and communication Management
Tassabehji & Moorhouse, 2008	Technical (incl. Advanced procurement process), External enterprise	Interpersonal Internal enterprise Strategic business skills

Table I: Buyer skills and competencies classifications

Purchasing professional personality traits

The extant research concerning purchasing professional personality attributes remains scattered and without theoretical anchoring. For example, Killen & Kamauff (1995) identifies four key buyer personality attributes: integrity, initiative, self-esteem and decision-making without further elaboration. Faes et al. (2001) lists 21 traits important to procurement professionals, eight of which can be considered personality attributes: integrity and honesty, self-confidence, perseverance, adaptability, extroversion, self-discipline, creativity and empathy. These traits are then clustered to one of the five buyer profiles. Other scholars mention personality traits only in passing as a prerequisite for specific buyer types such as "empathy" for the "Stimulator" buyer type (Bichon et al, 2009), or include them into a skill group such as communicativeness and persuasiveness into Interpersonal skills (Tassabehji & Moorhouse, 2008), patience and flexibility into Behaviour skills (Carr & Smeltzer, 2000), creativity into Behavioural skills (Giunipero, 2000), integrity, honesty, enthusiasm or carefulness into Personal skills (Wu et al., 2013), ambition, organizing or self-discipline into Interpersonal/Managerial skills (Gammelgaard & Larson, 2001).

Missing the guidance from the extant supply chain literature, we therefore adapt the widely cited and accepted Big Five personality dimensions model (Goldberg, 1981) which is based on the large sample factor analysis and was successfully substantiated by subsequent research. The five dimensions, also referred to as personality traits or groups, are Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. As Neuroticism may have negative connotations, we replace it by a neutral term Emotional stability (Barrick & Mount, 1991). Table II. outlines the continuum of each personality trait and provides typical features associated with it (e.g. Goldberg, et al., 1990; John & Srivastava, 1999; Barrick & Mount, 1991; Judge et al., 1999).

The Big five model is frequently applied to the job related research such as personnel selection, job search, training and development, or career success (e.g. Barrick & Mount, 1991; Judge et al., 1999; Kanfer et al., 2001) and suggests that high Conscientiousness scores are a good generic predictor of occupational success and superior job performance (Hurtz & Donovan, 2000), while high Extraversion and Agreeableness are particularly relevant for successful salesmen (Barrick & Mount, 1991), or that Extraversion leads to better training performance.

The Big five model was also applied in SCM research: Brauner et al. (2013) do not find any significant logistics task performance differences related to personality traits. The performance varies only based on the gender and technical self-efficacy. Periatt et al. (2007) then use the personality traits as the predictors of customer orientation and conclude, that the Openness to experience, Agreeableness and Conscientiousness should be a relevant hiring criterion for customer-oriented logistics personnel. Furthermore, they find that the relative importance of personality traits change with employee's seniority, highlighting the importance of Extraversion for managers and Openness to experience and Agreeableness for frontline employees. Conscientiousness, on the other hand, is equally important across all seniority levels.

Personality traits continuum	**Typical operationalization:**
Open to experience (different culture) Versus Closed to experience	- Associated with imagination, culture, intellectual curiosity, and artistic sensitivity, - Seeking out intense, euphoric experiences, - Preference of variety,
Conscientiousness (conscience, conformity) Versus Lack of direction	- Being careful, thorough, responsible and planful, - Organized and efficient, - Self-discipline, - Aim for achievement,
Extraversion Versus Introversion	- Optimism, spontaneity, - Energy, - Sociability, - Talkativeness, - Attention-seeking,
Agreeableness Versus Antagonism	- Compassionate, trusting, likeable, - Cooperative, - Well-tempered,
Emotional stability Versus Neuroticism	- Impulse control, - Calmness,

Table II: The big five dimensions and typical operationalizations.

Research methodology

Our research started as the test of extant literature conclusions that different buyer skills and competencies are required for different hierarchical levels. However, it became exploratory once we turned attention to the purchasing professional personality traits. This section first discusses the rationale for choosing job advertisements as a suitable data collection method for buyer skills/ competencies and personality traits analysis. We then outline the two step thematic analysis with a-priori codes.

Job advertisement analysis

Existing procurement skills and competencies research is both conceptual (e.g. Anderson & Katz, 1998; Feisel et al., 2008) and empirical. The close inspection of the supporting evidence reveals its grounding in practical experience and buyer in-depth interviews (Tassabehji & Moorhouse, 2008; Giunipero, 2000) or purchasing manager surveys (Mulder et al., 2005; Kolchim & Guinipero, 1993; Faes et al, 2001). While purchasing professionals are certainly knowledgeable informants, we cannot exclude the self-reporting bias (e.g. Jenatabadi et al., 2013) nor social desirability bias (e.g. Kovács, 2008).

To eliminate this potential weakness and gain novel insights, we opted for the job postings analysis. This approach allows us to focus on the skills and traits perceived as important not by the buyers themselves, but "by the company," as employees from different departments take part in the job advert composition (Askehave, 2010), and to collect a significant amount of data from different companies and industries. To the best of our knowledge, no paper uses job advertisements analysis to explore procurement manager competencies and personality traits.

Sodhi & Son (2010) document that the job postings analysis is a well-established research method and show that most studies use the sample sizes of 400 to 2.000 advertisements depending on the industry and geographical location, and employ geographical or economical segmentation criteria in subsequent analysis. Older studies (e.g. Todd et al., 1995) use newspaper job postings while recent papers (e. g. Chao & Shih, 2005) leverage the job posting websites. This paper closely follows the methodology employed by Schlee & Harich (2010) who evaluate the knowledge and skill requirements for marketing related jobs (e.g. Schlee & Harich, 2010).

Data collection

The job postings were collected between January and May 2017 on the three most popular job sites in the Czech Republic: Prace.cz, Jobs.cz, and Monster.cz. The former two are more generalist while latter is senior and expert jobs focused. We searched the Czech term "nákup" (roughly equivalent to "procurement") and the English term "procurement"). We made a screenshot of each posting and gave it a specific number. Each entry includes the posting title, organization name, industry (manufacturing, retail or services), date, source, hierarchical position and job advert text.

We eliminated duplicate postings (posted on multiple sites, in multiple regions by the same company or the same job advertised by different agencies). We also eliminated supply chain positions which did not concern primarily the procurement such as logistics manager or warehouse manager. In total 432 postings were collected.

Method of analysis

Thematic analysis is a qualitative research method to identify patterns within the gathered data (Boyatzis, 1998). It is an iterative process where the initial codes and analysis are often refined or completed with emerging themes. We opt for the thematic analysis approach because the sample data contain many equivalents for the same skill or personality trait and because the exact context is key.

We started our analysis with *a priori* codes of the phenomenon of interest to avoid subjective biases (Boyatzis, 1998). The main five skill groups were labelled following Tassabehji & Moorhouse (2008) taxonomy and were further broken down into subgroups following Giunipero (2000), Tassabehji & Moorhouse (2008) and Mulder et al. (2005). We coded as "Others" any skills or competencies that did not match the *a priori* codes. As the "Others" group was surprisingly large, we revisited the extant literature and added the group labelled "Personality traits" which we subdivided following the Big five personality traits model (Barrick & Mount, 1991).

While buyer skills and competences are well defined in the extant literature, we had to adopt a different strategy for buyer personality traits. Firstly, to avoid cross-cultural and cross-language differences, we confirmed that the Big Five personality traits are applicable for the Czech cultural environment (e.g. Hřebíčková & Ostendorf, 1995). Subsequently we created an initial coding protocol that we progressively refined and adapted to the procurement context through the iterative and interpretive thematic analysis.

Unlike Schlee & Harich (2010) who deduce the position from the required job experience, we use *a priori* codes adapted from Mulder et al. (2005): Junior Buyer, Buyer, Strategic Buyer and Purchasing Manager.

Data coding

We coded the data manually due to the context importance in interpreting the skills and personality traits (Sodhi & Son, 2010). To minimise the marker bias, we operationalized every

code through a coding table (Boyatzis, 1998), used three independent markers (e.g. Schlee & Harich, 2010), and developed a common and unified reference for markers (e.g. Bernardin & Buckley, 1981). We reviewed the coding criteria after approximately 10 % of the data. No major adjustments were necessary, though we added keywords for each sub-category to facilitate the coding process. We achieved 87 % interrater reliability and all differences were resolved through the subsequent group discussion.

Findings

This section first provides the basic data description in Table III. We then summarize our findings concerning the buyer skills along different hierarchical levels, and conclude with the buyer personality traits exploratory study.

Category	**#**	**Sector**	**%**	**Job posting distribution**	**%**
Job postings analysed	432	Manufacturing	60%	Junior buyer	16%
Individual codes	3 877	Retail	31%	Buyer	44%
Average codes per job posting	9.0 STDDEV 3.3	Services	9%	Senior buyer	23%
				Purchasing manager	17%

Table III: Descriptive analysis

Buyer skills and competencies

Turning attention to the number of required skills per job advertisement, the Junior buyer requires on average 7 skills and the Buyer 8.5, while the Strategic buyer 11 which is more than the Purchasing manager with 9.5. This suggests that the Senior buyer is considered a highly specialized position which employers define as precisely as possible.

The average number of required skills per posting illustrates the Technical Skills dominance with 3.4 skills per advertisement. It contains both the generic skills such as computer literacy and the procurement specific skills such as the purchasing process or product knowledge. Interpersonal skills were mentioned once per job posting on average while the remaining skills appeared only 0.4-0.6 times on average. Two other requirements not mentioned in the extant literature came out in 93% of advertisements: the foreign language proficiency (78% of adverts) and the relevant job experience (57%).

Breaking our analysis down to the four hierarchical levels allows us to shed light on the skill requirement distribution (Table IV).

Skill group	**Techn.**	**Interpers.**	**Intern.**	**Extern.**	**Strat.**	**Others**	**Pers. Traits**
Junior B.	2.4	0.8	0.3	0.1	0.2	1.0	2.1
Buyer	3.6	0.8	0.2	0.2	0.5	1.4	1.7
Strat. B.	4.4	1.3	0.5	0.7	1.0	1.6	1.6
Manager	2.5	1.4	1.0	0.9	0.7	1.7	1.4
Total	**3.4**	**1.0**	**0.4**	**0.4**	**0.6**	**1.4**	**1.7**

Table IV: Average number of skills and personality traits per hierarchical level

In summary, our analysis corroborates the extant literature predictions that different purchasing hierarchical positions require different skillsets. We document that not only the senior positions require more skills but they also demand more complex skills: Advanced technical procurement skills for Senior buyers versus the generic and rudimentary Technical skills specified for Junior buyers.

Desirable buyer personality traits

Buyer personality traits are under-researched in extant literature. Yet, at least one personality trait is mentioned in 74 % of job postings with the average of 1.7 traits per posting. Interestingly, the personality traits are distributed quite evenly across the hierarchical levels with the exception of Consciousness which significantly decreases with seniority: 1.4 mentions per Junior buyer, 0.8 for Buyers, 0,8 for Senior Buyer, and 0.6 per Purchasing managers.

Conscientiousness is by far the most desirable buyer personality trait and encompasses heterogenous traits such as independence (25 % of postings), responsibility (21%), compliance (14%), risk aversion (11%), diligence (6%), dependability (5%), consistence (5%) and task orientation (4%). It is followed by Openness to experience, also referred to as intellectence or culture (Goldberg et al., 1990), embodied by two dominant traits: the willingness to travel (16%) and willingness to learn and self-improve (7%). The Agreeableness subgroup is reduced to flexibility (20 %), the Extraversion equals buyer proactivity (13%), and finally, Emotional stability stands for the stress resistance (13%).

In summary, the personality traits appeared in 74 % of job postings. Consciousness was by far the most required personality trait followed by Openness to experience and Agreeableness. Extraversion and Emotional stability, on the other hand, seem less critical. There was no significant difference among hierarchical levels concerning the number or the required personality traits mix with the exception of Consciousness which decreased with seniority.

Discussion

Our research corroborates the extant literature claims that the required buyer skills and competencies vary for different hierarchical levels (Mulder et al., 2005; Tassabehji & Moorhouse, 2008). The difference is both quantitative and qualitative. The Junior buyer requirements are limited to a few generic Technical skills such as computer literacy or drivers licence which reflect the mostly mundane and administrative tasks such as ordering and purchasing process follow-up (Mulder et al., 2005). Buyers, on the other hand, require more advanced Technical skills and at least some Strategic business skills.

The significant qualitative leap can be observed with Senior buyers and Purchasing managers who are expected to possess the full range of skills. Interestingly, Strategic buyers require more Technical and Strategic business skills than Purchasing managers. A possible explanation is that Purchasing managers do not have to be the category experts but must possess some generic management skills (Giunipero et al., 2006) such as Internal enterprise and Interpersonal skills.

Language proficiency emerged as a widely demanded skill which has not been captured by the existing research. We believe that this is due to non-English speaking country context with a large share of foreign direct investments. Some advertisements even required an additional language (typically German or French). We expect similar results in most non-English speaking countries and argue that the language proficiency is key for modern buyers at all hierarchical levels and belongs to the basic Technical skills toolbox.

The importance, consistence and mix of required buyer personality traits suggests that employers share a very clear view of buyer personality: conscientious and able to work

independently, willing to travel, flexible, proactive and stress resistant. Previous research from other job areas suggests that Conscientiousness has the positive impact on job performance and is therefore desirable for most professional environments with the exception of Sales where the Extraversion is the key trait (Barrick & Mount, 1991; Periatt et al., 2007). From this perspective, the importance of buyer Conscientiousness is warranted, especially if we consider that it is embodied by the ability to work independently, assume responsibility and assure compliance.

On the other hand, personality traits associated with innovativeness such as intellectual curiosity, with boundary spanning such as sociability, or with the team work such as cooperation are completely missing. Similarly, the self-confidence and ambition were only almost absent. Such personality traits mix suggests that the purchasing job is still seen as a support function with mainly transactional and administrative tasks, far from the active and strategic role the extant and practitioner literature assigns to it.

Concluding remarks

This paper explores the skills and personality traits required for four purchasing hierarchy levels in 432 job postings in the Czech Republic. The selected data collection method purposefully deviates from previous studies which are based on surveys (e. g. Giunipero et al., 2006; Mulder et al, 2005) or in-depth interviews (e.g. Tassabehji & Moorhouse, 2008) and which may fall victim to self-reporting and social desirability biases.

Our original research question tested the extant literature proposition that more and qualitatively different skills are required for different buyer seniority levels. The results corroborate this claim: Junior buyers are expected to possess only generic Technical skills, while Senior buyers need to command the Advanced technical skills as well as some Strategic business skills. Finally, Purchasing managers witness the most balanced skillset requirement. We also document that the minimum work experience requirement is used as a skills proxy for Buyers and Strategic buyers. Finally, we complement the Technical skills with the foreign language proficiency which seems to be mandatory for buyers in non-English speaking countries.

Subsequently, we adapt the Big five personality traits model to shed light on the required procurement professional personality traits and conclude that there are no significant differences across hierarchical levels and that Conscientiousness is by far the most required trait, which suggests a somewhat administrative and support view of procurement.

Limitations and further research

While the adopted research method complements the existing research, it limits the generalizability of our findings due to the sample size, geographical range, and the data source which is biased towards the industrial buyer jobs. Yet, we believe that our research opens several research opportunities: Firstly, alternative personality traits frameworks may provide additional insight. Secondly, research covering a wider geographical or cultural area may reveal different key personality traits. Thirdly, different data sources and in particular the qualitative research approach may contribute to the initial theory development. Finally, a study exploring the link between the buyer personality traits and job performance similar to Martin (2011) research on salesmen would greatly contribute to our understanding of the construct relevance.

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Competing Futures: A scenario-based analysis of the future of procurement and supply management

Louise Knight[1], Joanne Meehan[2], Laura Menzies[3], Alexandra Pfeiffer[4] and Efstathios Tapinos[5]

1 Aston University, School of Engineering and Applied Science, Aston Triangle, Birmingham, UK, B4 7TE, tel: +44 121 2043605, email: l.knight2@aston.ac.uk

2 University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH, tel: +44 151 7953151, email: jomeehan@liverpool.ac.uk

3 University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH, email: l.a.menzies@liverpool.ac.uk

4 Aston University, School of Engineering and Applied Science, Aston Triangle, Birmingham, UK, B4 7TE, email: pfeifame@aston.ac.uk

5 Aston University, Aston Business School, Aston Triangle, Birmingham, UK, B4 7TE, email: e.tapinos@aston.ac.uk

Abstract

Based on primary research, TITANS and NETWORKED – two scenarios of the future of procurement and supply management (PSM) in fifteen years – describe how the wider business landscape might change and the consequences for PSM. Whilst the business landscapes portrayed are highly contrasting, and the overarching contribution of PSM in each setting is different, several key implications are the same for both scenarios. Findings are related to past research on PSM function maturity and strategic contribution. They highlight a number of strategic 'blindspots' and discuss the need for deepening insight and improving foresight, particularly related to market concentration and dynamism.

Key Words: procurement, maturity models, scenario

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Introduction

Contemporary business environments are marked by rapid and constant transformations (Kamann, Dullaert and de Leeuw, 2016, Steiber and Alänge, 2016). Organisations' responses to these transformational forces impacts their competitiveness, effectiveness and sustainability, and include a range of challenges for procurement and supply management (PSM). Despite many studies by consultants and professional associations on the future of procurement and supply management (FPSM) and the future of supply chain management (FSCM), academic studies are limited in volume, and few explore the *combined* impact of supply-side macro-environmental challenges, or the consequences for PSM. Relevant PSM knowledge is available, but fragmented, often implicit, or focused on a specific sector or factor.

FPSM as with any other field, is a difficult, complex area of study – the future landscape is not necessarily a continuation of the past and present, and developments are not deterministic. Powers of prediction are limited to short time frames, and even then, unexpected events occur. Paradoxically, these challenges increase the importance of future-orientated research (May,

1982). Future-orientated studies can help stimulate debate on preparedness for change. The best way to predict the future is to influence the discussions on what it could, or should be (Corley and Gioia, 2011).
A common theme across these studies is repositioning PSM's contribution as strategic. In this paper, we argue that the notion of strategic PSM should include consideration of a wider influence, particularly around collective actions that cumulatively shape future supply markets. This does not imply a normative positioning of PSM practice; it is an acknowledgement that PSM actions do not purely react *to* future markets, but that current practice *shapes* them. If PSM is to be truly strategic, its preparedness to respond to macro transformations and its capability to inform, influence and shape organisational directions and the wider business context must be addressed. The study addresses three research questions: (RQ1) In 15 years+ time, how might the context for PSM have changed? (RQ2) In such circumstances, how would PSM contribute to organisational goals and performance? (RQ3) What are the implications for PSM development?

Based on literature, interviews and workshops, we developed two FPSM 'plausible futures' (Wright and Goodwin, 1999). Importantly, these scenarios are not forecasts, just possible futures, used here to frame a research agenda. We link our study to purchasing maturity research to understand what outcomes a high performing PSM function of the future would deliver and how this would be achieved through practices, structures and other attributes. Our contribution concerns 'prescience', "the process of anticipating what we need to know, and ... influencing the intellectual framing and dialogue about what we need to know to enlighten both academic and reflective practitioner domains" (Corley and Gioia, 2011: 13). It aligns with growing calls for more engaged, participatory, management research, in response to the criticisms of scholarly irrelevance to practical issues (Bennis and O'Toole, 2005), and increasing recognition of PSM-related activities' impact on societal and environmental degradation (Meehan, Touboulic and Walker, 2016). The need for future orientated research embracing 'disciplined imagination' (Weick, 1989) is appropriate for emerging phenomena or new paradigms where, by their very nature, empirical data are not available (Fawcett, Waller, Miller, Schwieterman, Hazen and Overstreet, 2014).

Literature Review: procurement and supply management maturity
FPSM studies tend to look backwards, using content analysis of prior academic literature, to draw conclusions on future trends (Giunipero, Hooker, Joseph-Matthews, Yoon and Brudvig, 2008, Mogre, Lindgreen and Hingley, 2017, Spina, Caniato, Luzzini and Ronchi, 2013, Zheng, Knight, Harland, Humby and James, 2007). Some use case studies and participatory interviews (Carter and Narasimhan, 1996, Storey, Emberson, Godsell and Harrison, 2006, Tassabehji and Moorhouse, 2008). More innovative, future-orientated methods have yet to be widely adopted. Misalignment is a common theme in prior studies whether in theory-practice gaps (Storey et al., 2006), differences between functional-organisational perceptions and expectations (Tassabehji and Moorhouse, 2008), or in problems defining boundaries between the function and its processes (Zheng et al., 2007).

The dominant message in prior studies is that purchasing and SCM have strategic potential (Carter and Narasimhan, 1996, Giunipero et al., 2008, Mogre et al., 2017, Storey et al., 2006, Tassabehji and Moorhouse, 2008). Strategic impact is variously positioned including improved supply structures and cost improvements (Carter and Narasimhan, 1996), sustainable practices (Carter and Narasimhan, 1996, Mogre et al., 2017), skills development (Tassabehji and Moorhouse, 2008), and digital and e-business (Mogre et al., 2017, Zheng et al., 2007). Despite PSM's role in supply chains and, with the exception of the sustainability agenda, PSM's

strategic influence is still focused within the organisation, rather than the wider consequences of supply-side actions. Organisations are seen as market-taking (Spulber, 1996), rather than active in shaping markets through their sourcing decisions (Grandia and Meehan, 2017, Knight, Pfeiffer and Scott, 2015). And yet it is recognised that the political power of a few corporates grows as their revenues rival those of national governments and influence impacts beyond their contractual reach shaping markets, policy and society (Zingales, 2017). The potential wider role in market shaping is recognised in public procurement (Caldwell, Walker, Harland, Knight, Zheng and Wakeley, 2005, Grandia and Meehan, 2017, Knight et al., 2015). The collective impact of supply decisions in other sectors attracts little academic attention (e.g. Grandia and Meehan, 2017, Knight et al., 2015).

Strategic procurement implies procurement maturity. Maturity models commonly establish auditable, cumulative stages, typically from a process orientation through to a sophisticated value-based contribution (Rozemeijer, Weele and Weggeman, 2003). Van Weele, Rozemeijer and Rietveld, (1998) offer the only procurement maturity model that explicitly states the importance of both internal and external integration as separate stages. The staging of the maturity models has tended to ignore the factors that influence evolution and change, though more recent research acknowledges that adaptive change is situational and context-dependent (Andreasen and Gammelgaard, 2017). Empirical research highlights the importance of enablers (employee capabilities, training, IT system support, and performance tracking) to act as catalysts to more mature procurement activities and in developing strategic alignment between resources, capabilities and competitive advantage evolution (Kerkfeld and Hartmann, 2012).

Maturity is often taken as a proxy for strategic impact, yet there are arguably some subtle differences. Maturity relates to the range and scale of activities undertaken (Rozemeijer et al., 2003) while strategic procurement relates to the demonstrable impact of these activities in a competitive context. Evidence of the links between these is still lacking (Zimmermann and Foerstl, 2014). Common assumptions are that internal stakeholders will buy in to a mature procurement function, that organisations will empower buyers to undertake strategic activities, and that PSM will follow a predictable development path. We need however to understand what a high performing PSM function of the future would deliver (outcomes) and how, without assuming incremental change is possible. We also need to be open to pathways to different plausible futures, which might be very different to past development trajectories.

Methodology

Scenario planning as a research methodology is growing in popularity (Ramirez, Mukherjee, Vezzoli and Kramer, 2015). The philosophy of this method is not about prediction per se, but an opportunity to explore critical drivers and uncertainties and consider plausible images of the future. This study is a scenario exploration (Rowland and Spaniol, 2017). Following Tapinos (2012) the process has two key aspects: i) developing scenarios ii) exploring their impact. This allows us to: debate and define potential radical shifts in supply landscapes and PSM data/systems; develop scenario narratives that are plausible, coherent and thought provoking; and elucidate potential implications for PSM's future contribution, activities and resources. The narratives are critiqued in light of broad ranging future studies (i.e. not PSM-specific), and past research on purchasing and PSM's functional maturity and strategic contribution.

The study followed the most common steps of the intuitive logic scenario process (Hussain, Tapinos and Knight, 2017). Preparation involved desk-based review of academic and professional literature on macro-environmental forces and their impact. Interviews with 20

senior executives, consultants and academics from a range of sectors allowed us to explore awareness of, and responses to, these trends, and probe the driving forces and uncertainties. We built two scenarios inductively (Ramirez et al., 2015). Insights from the interviews formed part of the introductory briefing for six workshops with PSM senior experts to verify the uncertainty dimensions, elaborate the scenarios and consider their impact on PSM. With the emphasis on disruptive change and tipping points found in literature and our fifteen-year time horizon, we focused on radical change both to PSM data and system and to the supply landscape. Workshops were recorded and transcribed, and analysed using NVivo to enable open and axial coding.

The degree of change envisioned by participants was not as extensive as expected from the literature and interview stages. Whilst the workshop discussions revealed some significant gaps in issues capturing participants' attention, the analysis provided a strong basis for writing the first scenario, TITANS. Further analysis and revisiting literature on macro-environmental trends led us to recognise a coherent set of factors presented in future studies (e.g. Dewing and Jones, 2016), which were neglected in TITANS. These factors formed the core for the second scenario, NETWORKED. Thus, whereas the TITANS scenario is tightly linked to the interview and workshop data, reflecting the voice of PSM experts, NETWORKED is strongly influenced by our reading on macro-environmental forces, and so reflects the voice of experts in PSM future studies. The logic, coherence and plausibility (Wright and Goodwin, 1999) of the two inductively derived scenarios were assessed through further analysis (see themes in Table 1) and literature review, following up on key themes such as market concentration. The full scenario descriptions are provided in the study report published by the Chartered Institute of Procurement and Supply (available via CIPS website or from the authors).

The TITANS Scenario

Named after the 'tech titans' (Apple, Google etc) but also considering firms in infrastructure sectors, the TITANS scenario describes a highly polarised business landscape in terms of firm size and power, with tight-knit business groups centred on titan firms. Paradoxically, better data will underpin collaboration and deep integration of business groups, as well as fuelling rivalry between them. Beyond and around the business groups, commercial interactions will be short-term and arms-length, even for higher value/higher risk items, many of which will have become commoditised.

Familiar structures will have disappeared with banks, contracts, and accounting methods fundamentally different. Distributed ledger technology (DLT) will be used for crypto-currencies, smart contracts, and monitoring compliance. DLT will be widely deployed by traditional businesses; private control will reduce its potential for full transparency. Algorithms take decisions on new potential suppliers, sourcing, contract management and de-listing non-performing suppliers. Decisions will be brand and sustainability 'blind' unless such criteria are explicitly written into algorithms. For many purchases, there will be reduced attention to sustainability and price-dominated decisions. Reduced cost and increased speed of transactions will reduce the relative benefits of supply base consolidation and enable rapid switching. Market dynamism will be much increased. Firms will more frequently adapt their business strategy, often diversifying and integrating with partners. Buyers will have to work with less predictable suppliers and will more often find they have to compete for supply.

Many supply chains will have been radically reconfigured, driven by widespread adoption of additive manufacturing (3D printing) and servitisation. Data-driven integration will generate supply chains that are highly efficient but very vulnerable to shocks. Attention will shift from

resilience towards agility. In the highly dynamic and unpredictable business landscape, PSM leaders will emphasise 'future-proofing', strengthening capabilities to cope with, and capitalise on, whatever future unfolds. Agile sourcing will be a key capability, enabled by advanced systems and big data. Data security will be a huge risk, with supplier breaches having the potential to destroy firms. Managing relationships with outsourced systems and data providers, and key intermediaries, will become a strategic category in its own right.

PSM leaders' principal strategic contributions will be risk management and supporting business strategy. Risk management will manage the increased uncertainty from market dynamism, dealing with volatility and unpredictability. PSM experts will manage supply-side resources to facilitate rapid adjustment of business strategies. Developing plausible futures, combined with advanced analytics skills will be essential for accessing, interpreting and acting on hard data and weak signals about critical changes in the environment.

The NETWORKED Scenario

The NETWORKED landscape will be characterised by more evenly distributed firm size and market power, and tightly embedded inter-organisational relationships. Widespread coordination between organisations will pool resources, and enable co-buying, often centred on regional networks. Reciprocal trading, with offset agreements and counter-trade will increase. Flatter organisational structures, the sharing economy and public scrutiny, will see decision-making significantly influenced by a wider range of stakeholders, and transparency and accountability will be increasingly valued over speed. Extensive use of virtual and augmented reality will facilitate business communications, enabling remote employee working across organisational boundaries. Reflecting increasing expectations and engagement in local communities, and reducing hierarchical power, the relative influence of central government will be reduced. This will provide benefits, but also lead to a rise in patronage.

Competition regulation will shift from prioritising price protection for consumers to assessing the impact of potential developments against social, environmental and economic outcomes. Informed by predictive analytics, the long-term cumulative impact of local decision-making and supply chain resilience will be critical factors in decision making. Competition regulation will also dampen rivalry and, in turn, affect innovation. The challenges experienced by big firms will reduce R&D budgets, with a consequent slowdown in innovation. Other approaches will partly close this gap, such as community-based crowdsourcing innovation. Reduced budgets will also mean innovation spreads by contagion rather than by marketing efforts. The widespread adoption of additive manufacturing will drive significant shifts to local manufacturing. With increased customisation of products at relatively low costs, the value of differentiation by brand will significantly decrease.

PSM leaders' principal strategic contributions will centre on network coordination and supporting network strategizing. A key challenge will be balancing the organisation's own interests and the collective interests of the business' wider community of stakeholders. These interdependencies will slow decision-making, and reduce market dynamism. PSM leaders' efforts to prepare for the future will centre on enhancing foresight, developing scenarios and analysing their implications, often collaboratively, with a view shaping emerging futures.

Contrasting Scenarios

The business landscapes portrayed in TITANS and NETWORKED would not co-exist, since their emergence would depend on highly divergent business behaviours, social change and government policies. The TITANS scenario speaks to powerful corporate models that promise

ever more cost reductions, technical innovations and efficiencies, but which also threaten abuse of market power. Organisational power shapes not only their supply chains and markets but also entire competitive fields and societal values. Owing to this dependence, failure of a major organisation could be catastrophic across multiple supply chains. The NETWORKED model is not developed as an idealised counterpoint to TITANS, but to highlight important factors raised by future trend experts not aligning with TITANS. NETWORKED's potential advantages include organisations giving greater attention to external stakeholders' interests, and taking account of the cumulative effects of network members' procurement decisions, for mutual long-term gain. Different risks would exist, particularly around speed of recovery from supply chain shocks and the rate of innovation. Organisations will strive for resilience to predict, adapt to, and recover from disruptive events. In the TITANS scenario, resilience will be displaced by agility, which is centred less on anticipation, and more the speed of response to changes.

SUPPLY LANDSCAPE AND THE WIDER BUSINESS CONTEXT		
Theme	TITANS	NETWORKED
Ownership of data and systems	Concentrated ownership of data and systems Company-centred initiatives on data privacy etc.	More distributed ownership of data and systems Strong regulation on data privacy, security etc.
Market configuration and dynamics	Polarising and concentrating market structures Predominantly for-profit intermediaries Highly dynamic and competitive markets	Fewer very large firms, more smaller ones, more diversity in business models Mixed economy of for-profit and NFP intermediaries. Rivalry dampened
Dominant axis of collaboration	Business groups	Regional networks, many city-based
Changing business strategy	Strategies frequently and rapidly adapted	More stable business strategies
Innovation rate and drivers	Innovation driven by titans	Innovation slowed – less investment, less marketing – slower diffusion
Interest in sustainability	Regulation driven attention on sustainability	Community-pull on sustainability
Value of brand	Price and 'hard' quality measures trump brand	Social capital is brand
Critical success factors	Success comes from rapid adaptation and agility, and collaboration in tight-knit business ecosystems	Success comes from network strength and resilience, and tight-knit regional collaboration

Table 1: Extract from CIPS report, summarising the scenarios against key themes

Despite their fundamental differences, it is noteworthy that the two scenarios have some PSM implications in common. In both, the majority of product purchasing is commoditised and/or automated, eroding margins and intensifying competition, particularly in the online space. In combination, DLT, predictive analytics, machine learning, the Internet of Things, and robotics will reconfigure supply chains and radically change the inter-organisational interfaces. Servitization and additive manufacturing will also lead to new intermediaries and the reconfiguration of many supply chains. In TITANS, brokers will be predominantly for profit, whereas in NETWORKED there will be a mixed economy.

Within TITANS, the overarching focus will be on risk management. PSM experts will be called upon to enable organisational business strategy, leveraging the supply base to support rapid reframing and repositioning in response to highly dynamic environments. Core activities will shift to managing intermediaries, (re)configuring supply chains for greater agility, dealing with the unexpected, rapid sourcing, and developing mitigation strategies for coping with very powerful suppliers, whether these are micro-suppliers with critical IP or Titan companies. By contrast, under NETWORKED, PSM experts' critical role will be in network coordination, focusing on developing network-level strategies and coordination to bridge upstream and downstream members of the network. Frequent, gradual adjustments will be needed as collective and organisational goals are revisited in light of feedback. Core activities will include consortia contracting, strengthening supply arrangements for greater resilience, forecasting the

impact of decisions, relationship development, and developing strategies for coping with powerful suppliers centred on learning and collective action.
Both scenarios present three key PSM roles. The first is strategy facing, and concerns interpreting business needs, identifying how these can be met through suppliers and defining PSM's contribution. The second is (IT) systems facing, translating PSM needs into systems and data requirements. Managing PSM systems will be a central activity, as the function shifts from directly acquiring specific goods and services, to designing acquisition systems and underpinning policies. The third role is category, relationship and supplier management in the relatively rare cases where these activities cannot be fully automated or outsourced.

Discussion

Perennial Issues and Strategic Blindspots

Future-focused thinking is not easy particularly in fast-paced, high-pressure environments. Despite decades of maturity research four perennial themes still dominate discussions about the future of PSM – strategic maturity, data revolution, (lack of) skills and capacity, and professional recognition. These issues' persistence and a natural leaning towards incremental change seem to create 'strategic blindspots', as illustrated through three insights from our study. First, discussion of future data systems tended to centre on the ability to conduct current tasks more efficiently, rather than the exponential gains and risks of transformative, or game-changing data and systems. Improved systems capability would facilitate management of more *complicated* supply systems and decisions, but were not necessarily seen as facilitating more *complex* activities such as network collaboration, competitive intelligence or modelling the impact of sourcing on market dynamics. Second, most mentions of the rise of Amazon centred on efficiency gains and assumed it was inevitable. Participants tended not to consider the implications for market concentration and value appropriation, or that Amazon's growth is driven by buyer behaviour. Third, although concerned about data security, risks to decision making quality stemming from problematic algorithms (O'Neil, 2017) that might lead to counter-productive outcomes in the longer term (especially with respect to ecological and social outcomes), were not discussed.

Developing a rich description of the scenario and debating its implications, rather than exploring the impact of a long list of future trends (e.g. Carter, Carter, Monczka, Slaight and Swan, 2000) allows gaps in attention to be considered more critically and holistically. In this study, participants were invited to 'uncouple' their thinking from immediate roles and sector contexts, relying more on their professional expertise and general knowledge. As researchers, we can relate emerging findings to future studies (e.g. Dewing and Jones, 2016) and highly contemporary discourse about challenges we face (c.f. O'Neil, 2017, Sas, 2017, The Economist, 2016). Furthermore, as Gowing and Langdon's (2016) evidence shows, many of the most senior business and public sectors leaders seem unable to 'think the unthinkable' and, when they do, the attention to supply-side aspects is very limited (Schwab, 2017).

Market Concentration and Market Dynamism

The combined influence of organisations' PSM practices and decisions affects far more than their individual commercial performance. It generates market structures and dynamism. Issues of power and lack of corporate diversity have cumulative impacts on people, organisations, markets, the natural world, and society. Even for today's best-in-class PSM functions, some reframing of supply-side priorities would be needed to reshape market concentration, in the case of TITANS, and develop the lack of market dynamism, in the case of NETWORKED.

The political implications of market concentration (Zingales, 2017), markets and innovation policy (Mazzucato, 2015), and zero-growth economics (Barrett, 2018) are all topics which relate directly to calls within our field for truly sustainable supply chains (Montabon, Pagell and Wu, 2016). And yet, as Knight et al., (2015) review found, what little attention has been paid to market shaping and innovation within the field of PSM is either just public sector focused and/or not recent. Some developments in neighbouring fields such as marketing and industrial marketing are promising. Nevertheless, we conclude that PSM scholars need to find ways to rapidly engage with on-going debates in economics and in innovation policy, and to capitalise on recent research in B2B marketing. This should be done synergistically with PSM leaders' initiatives to broaden the horizon of FPSM discourse.

Influence of PSM

Both scenarios suggest that leaders need to identify, evaluate and challenge the assumptions and norms that frame typical efforts to plan for the strategic development of PSM. Strategic blindspots limit critical reflection. PSM professionals may find their field moving into a future that does not deliver what is needed for their organisations, that they don't want, and for which they are not prepared. The future of PSM is however not the exclusive concern of PSM leaders. It invites serious consideration from a range of stakeholders, including organisational leaders. Market concentration and dynamism in B2B markets are of interest to them and others, such as regulators. Debate needs to grow in scope from how to increase the strategic influence of PSM professionals within organisations to include the wider impact of PSM choices, individually and collectively. This brings us back to the need to recognise and draw attention to strategic blindspots and questions how PSM can take a lead in addressing market concentration and/or dynamism. Recent developments in PSM maturity research which emphasise contextual factors such as political influence as part of a more nuanced understanding of maturity (Andreasen and Gammelgaard, 2017) provide an important foundation for such initiatives

Conclusion: Connecting to the Future

This study suggests an urgent need for more future-focused studies. Despite converging themes of power, intermediation and cooperation, the TITANS and NETWORKED scenarios are competing potential futures. A key question for organisations and PSM professionals is how to recognise critical developments that would signal whether we are transitioning towards one or other scenario. Further research adopting a scenario based approach could usefully address these 'flexpoints' (Hussain et al., 2017, Strauss and Radnor, 2004).

NETWORKED reflects the expectations captured in a major foresight study (Dewing and Jones, 2016). The embeddedness of actors, the importance of external stakeholders in decision-making and the slowing of innovation are all features which, for us, evoke many aspects of the public sector today. TITANS reflects participants' expectations well but, for many of them, not their values. Developing and using scenarios are highly value-laden activities. The role of values should receive direct consideration in future research. More research is needed to support the development of capability and capacity in preparing for/influencing the future in the PSM domain. As the field of PSM has matured, research has become more theoretically and methodologically sophisticated, with exploratory and inductive research becoming relatively less popular. Whilst we recognise that future focused studies will be seen by some as compromising those rising standards, we draw inspiration from the problematising approach to developing research questions (Alvesson and Sandberg, 2011), critiques of formulaic research (Alvesson and Gabriel, 2013) and the notion of making a contribution to research through prescience (Corley and Gioia, 2011).

From a practice perspective, both the study participants and we as researchers found it difficult to be future-focused and 'non-incremental' in our thinking. As the perennial issues and blindspots show, PSM experts, just like CEOs and top civil servants find it extremely difficult to assimilate information on rapid change in business environments, and think the unthinkable and the unpalatable (Gowing and Langdon, 2016). A crucial point apparent within the two scenarios is that supply managers are not passive actors. Supply-side management choices will shape the emerging landscape. Futures are organic, malleable and adaptive. The PSM community – practitioner and academic – needs to initiate debate, challenge current practices and build the capabilities and the capacity to develop new, appropriate PSM options, rather than sleepwalking into undesirable futures.

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Purchasers' Personality Profile

Volker Koch*[1], Bernd M. Zunk[2], Klaas Stek[3]

[1] Graz University of Technology, Institute of Business Economics and Industrial Sociology, Kopernikusgasse 24/II, 8010 Graz, Austria;
Email: volker.koch@tugraz.at; phone: +43 316 873 7283
[2] Graz University of Technology, Institute of Business Economics and Industrial Sociology, Kopernikusgasse 24/II, 8010 Graz, Austria;
Email: bernd.zunk@tugraz.at; phone: +43 316 873 7784
[3] University of Twente, School of Behavioral Management and Social Sciences, Department of Technology Management & Supply, PO Box 217, 7522 NH Enschede, The Netherlands
Email: klaas.stek@utwente.nl; phone: +31 53 489 44 40
*corresponding author

Abstract

This paper aims to analyse the personality profile of professional purchasers against the background of the "Big Five Inventory". A research model was designed based on the five dimensions of a personality as identified in the "Big Five Inventory". An online questionnaire was sent out to purchasing professionals to test this model. Data from 82 responses is collected and used to analyse the personality profile of professional purchasers. The findings of this study aims to help human resource managers to identify an appropriate personality for a position in purchasing departments.

Keywords: Big Five Inventory, personality, purchasing professionals

Introduction

The improvement of business performance is the focus of many different research fields. The performance of purchasing departments in particular contributes significantly to overall business success and needless to say this is always influenced by those individuals who are employed as professional purchasers (Caniato et al., 2012; Foerstl et al., 2013; Hüttinger et al., 2012; Nair et al., 2015; Van Weele, 1984). An interesting individual key factor of the people who work as professional purchasers is that of their personalities. Over the past few years, the interest of many personality researchers has concentrated on the structure and concepts of personality. Researchers agree that there are different robust factors of personality which can serve as meaningful parameters for classifying personality attributes (Barrick and Mount, 1991; Hurtz and Donovan, 2000). Ever more executives today rely on employee personality analysis to optimize their workforce. In the light of these developments the paper considers the research question: What are the personality characteristics of professional purchasers? Although the problem is not new because many researchers tried to profile purchasers (Knight et al., 2014; Koponen, 1960) the key concept of this issue is an economic method for the measurement of personalities of purchasers (Carlo et al., 2014; Flake et al., 2017). In a next step the inclusion of a performance construct of purchasers is useful to get a connection between personalities and performance of purchasing professionals (Caniato et al., 2012; Nair et al., 2015; Wen-li et al., 2003).\

The literature

Personality models attempt to analyse, structure and model the personalities of people (Barrick and Mount, 1991). In order to achieve this objective, the characteristics, the behaviour and also the physical dimensions of people are analysed and structured in groups. The resulting models should not be seen as dogmatic criteria, but merely as a useful means of systematically depicting and integrating personality differences. Personality models should also be easy to understand, to present and communicate and also show proper respect in dealing with people. The literature uses different models for the analysis of personality like Myers-Briggs indicator, Riemann-Thomann model or the "Big Five" dimensions of personality (Rammstedt et al., 2013; Riemann, 2013; Zeigler-Hill and Shackelford, 2018).

The Myers-Briggs indicator is based on Jung's inventory. It has a structure of 94 forced-choice items that yield scores on each of the eight factors as well as the famous four dimensions: introversion–extraversion, sensation–intuition, thinking–feeling, and judging–perceiving. Respondents are classified into one of 16 personality types based on the largest score obtained for each bipolar scale. The test provides linear scores on each dimension which are usually discussed in terms of types based on cut-off scores (Furnham, 2018).

The Riemann-Thomann model basically describes four opposing basic orientations of persons. These four basic orientations occur in everyone, but in different forms. Basic orientations of the human being can be seen in this model as a holistic state in which a feeling of well-being occurs in the person. These four basic orientations are: distance, proximity, duration, and change orientation (Riemann, 2013). These four basic orientations can be entered in a coordinate system, where the vertical axis includes the two extremes duration and change and the horizontal axis the distance and proximity. The vertical axis is the time axis and the horizontal axis is the space axis. This means that space and time are criteria in which people differ in their interaction (Geml and Lauer, 2008).

The "Big Five" dimensions of personality are applied together as an appropriate testing instrument (Seibert and DeGeest, 2017). Big Five Personality Dimensions (BFPD) were developed from multiple research efforts, which integrated more than 4,500 English adjectives that ended through research in five dimensions. With the combination of this five dimension all possibilities of describing a personality are included (Castillo, 2017; Mulyanegara et al., 2009; Rammsted et al., 2013). Such BFPD allow an average prediction of individuals' behaviours in many different situations and is mostly used in human resource management. Therefore, a personality can be defined as the way an individual's mental world is organized. Thus, based on this definition, researchers attempted to develop a framework that may come to explain individual differences. The Big Five model includes traits such as neuroticism, extraversion, openness, agreeableness and conscientiousness (Mulyanegara et al., 2009; Rammstedt and John, 2007). The ten item "Big Five Inventory" is an ultra-short test for assessing the five personality dimensions and this inventory is acceptable to use with a web survey (Rammstedt, 2007; Rammstedt and et al, 2016; Seibert and DeGeest, 2017). Furthermore, Rammstedt offers a very simple method for representing the personality structure on the basis of the mean values (Rammstedt et al., 2013) which makes the profiling of a personality profile very easy.

The methodology

In this section, we present details regarding the research instrument and measures and the sampling procedure that were used for developing our key constructs.

Research instrument and measures

Item measures for the personality construct in our study were adapted and built from existing scales and conceptual works of the Big Five Inventory-10 (BFI-10). The item pool was tested on academics by (Rammstedt and John, 2007). However, reverse coding and distributed placement of the item measures were used as a precautionary measure against potential response bias. Item scales were graded on a 1–5 likert scale basis, with 'strongly agree – strongly disagree' and anchors between. As a part of the scale refinement process, a preliminary survey was pilot tested among three academic and four professional experts. Table 1 shows the items based on (Rammstedt and John, 2007).

Table 1: Big Five Inventory-10 (BFI-10) based on (Rammstedt and John, 2007)

	Questions	**Dimensions**
	I see myself as someone who…	
(1)	…is reserved.*	extraversion
(2)	…is generally trusting.	agreeableness
(3)	…tends to be lazy.*	conscientiousness
(4)	…is relaxed, handles stress well.*	neuroticism
(5)	…has few artistic interests.*	openness
(6)	…is outgoing, sociable.	extraversion
(7)	…tends to find fault with others.*	agreeableness
(8)	…does a thorough job.	conscientiousness
(9)	…gets nervous easily.	neuroticism
(10)	…has an active imagination.	openness

*… item is reversed-scored

Sampling procedure

The sample frame was drawn of the "Federation of Materials Management, Purchasing and Logistics in Austria" (BMÖ) on a cross industry basis. The BMÖ represents a total population of about 1,600 purchasing professionals among all industries in Austria. Following (Bethlehem, 2010) and (Sax et al., 2003) guidelines, the final instrument was mailed via e-mail to all of the about 1,600 purchasing professionals of the BMÖ member list. About 950 e-mail addresses were no longer valid. The mailing package consisted of a cover letter and the link to the survey in lime-survey. A first reminder e-mail was mailed to all valid e-mail addresses of the members after two weeks and a second one after four weeks of mailing. Respondents were offered a summary report as an incentive to participate. Three mailings of the survey instrument resulted in a total of 82 responses, excluding returns, refusals and unusable responses. This results in a response rate of 12,62%. The answers concerning the business of the companies were divided by the economic activity classification ÖNACE of Austria and the distribution of the sample is shown in Table 2.

Table 2: Businesses of the sample

Businesses (ÖNACE)	
Manufacturing or manufacturing of goods (industry)	63%
Trade; maintenance and repair of motor vehicles	9%
Others	28%

The category “others” includes all businesses that have been named once. The maturity of the companies of the sample is working for industry. Respondents were from different purchasing functions like chief procurement officers, strategic and operative purchasers. Table 3 shows the distribution of the functions.

Table 3: Functions of the sample

Functions	
Operative purchasers	32%
Strategic purchasers	21%
Chief procurement officers	48%

The selected sample represent a cross-section of the purchasing functions. Table 4 shows the respondent profile of companies in the sample. It is shown that the whole profile of the companies is widely scattered.

Table 4: Respondent profile of companies in the sample

	mean	**std. dev.**	**min**	**max**
Number of employees	7,263	19,413	50	147,000
Number of employed purchasers	90	373	2	3,000
Turnover	€ 1,283 million	€ 4,191 million	€ 6 million	€ 32,000 million
Purchasing volume	€ 389 million	€ 902 million	€ 20,000	€ 4,000 million

Results

Confirmatory factor analysis (CFA) was used in order to simultaneously validate the measures of the Big Five Inventory-10 in the professional purchasing criteria construct. Also an exploratory factor analysis (EFA) preceded the CFA for the construct Big Five Inventory-10 in the professional purchasing. This step was undertaken to see whether the items underlying these constructs hold together as one construct or whether they form conceptually distinct factors. The EFA results suggested five distinct factors for Big Five Inventory-10. In the CFA, all items loaded on their hypothesised constructs. Factor loads below 0.3 are hidden. Reversed-scored items where recoded before. Table 5 shows the result of the principal component analysis of the CFA.

Table 5: CFA of the Big Five Inventory-10 in the professional purchasing criteria construct

I see myself as someone who…	**factors**				
	1	**2**	**3**	**4**	**5**
…is reserved.	0.851				
…is outgoing, sociable.	0.839				
…is generally trusting.					0.842
…tends to find fault with others.					0.786
…tends to be lazy.				0.825	
…does a thorough job.				0.784	
…is relaxed, handles stress well.		0.742			
…gets nervous easily.	-0.332	0.805			
…has few artistic interests.			0.841		
…has an active imagination.	-0.335		0.731		

(factors: 1=extraversion, 2=neuroticism, 3=openness, 4=conscientiousness, 5=agreeableness)

The overall model fit of the confirmatory factor analyses is weak in terms of the measure of sampling adequacy (MSA) because the Kaiser-Meyer-Olkin-criteria (KMO) reached only a value of 0.53 and is therefore as “miserable” to consider (Backhaus, 2008). Discriminant validity was evidenced at acceptable levels by means of an examination using the chi-square difference test (chi-square = 128,99; d.f. = 45).

Following evaluation is based on mean values, as described by (Rammstedt et al., 2013). In order to obtain measured values for the individual characteristics of the interviewed purchasers on the five personality dimensions, the answers to the two items are averaged per dimension. For this purpose, the respectively negatively poled item is first recoded and then the average of the recoded and the unrecorded item is formed per dimension. The range of values of the five dimensions is then between one (agree strongly) and five (disagree strongly) (Rammstedt et al., 2013). Figure 1 shows the result (n=82).

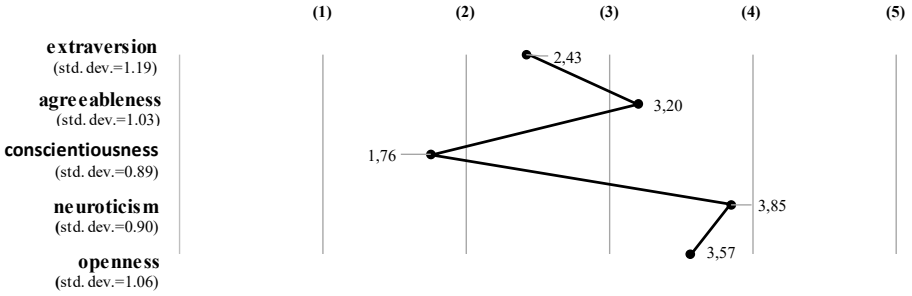

Figure 1: Personality profile of the sample of purchasing professionals

As a result of this evaluation, the personality of professional purchasers is very strong in dimension of conscientiousness and very weak in dimension of neuroticism.

Conclusion

The findings are intended to support human resources managers during staff recruitment processes to identify the “right personality” for a purchasing position in purchasing departments. It makes the appearance that the personality of purchasing professionals is very conscientiousness. The dimension of conscientiousness manifests itself through aspects such as persistence of behaviour, impulse control, success and task orientation and organization and thoroughness. Furthermore, people with a high level of conscientiousness are dutiful, orderly and purposeful (Lang, 2009). Conscientiousness is an important factor in predicting job performance among employees and workers (Hankes, 2011). The factor analyses shows that the theory of the Big Five is also found among the sample of purchasing professionals.

Limitation und future research

The study has a few limitations that present directions for future research. We consider data from Austrian companies which are mostly from the industry sector for informing our research. Furthermore, we cannot be certain whether these findings will hold in other geographical regions and businesses. Another limitation is a low number of only 82 participants which leads to the question of the quality of the factor analysis. Future research can consider a performance measurement model to link it with the personalities of professional purchasers to divide the personality profile into groups. Furthermore, future analysis of the data should consider

different personality characteristics depending on businesses and focus on the differences between the positions work experience, purchasing volume and operational or strategic purchasers. Also the prediction of purchasers' behaviours in many different situations gives room for further research.

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Leapfrogging and co-evolution
—
toward a maturity model for the digital transformation to Procurement 4.0

Abstract

Procurement 4.0 promises to change fundamentally the way buying firms collaborate with their suppliers. However, do buying firms and their suppliers have the required level of "digital maturity"? This study builds on a literature review and qualitative research to develop a *Procurement 4.0 maturity model*, which is then validated in a pre-study. In contrast to traditional company-centric procurement maturity models, the newly developed model takes a dyadic perspective to highlight the crucial role of *co-evolution* between the buyer and the supplier in the digital transformation to Procurement 4.0. The research further offers *leapfrogging* as a change process that contrasts with the traditional linear and gradual processes assumed in extant maturity models.

Keywords: Procurement 4.0; digitalization; maturity model; case study research

Introduction

The fourth industrial revolution, or "Industry 4.0", refers to a new way of organizing and controlling the entire value chain across product life cycles (Lichtblau et al., 2015). As Industry 4.0 reshapes global value chains, procurement—the central interface to internal and external partners—is at an important turning point (Henke and Schulte, 2015; Pellengahr et al., 2016). In the era of Industry 4.0, academics and practitioners have coined the term "Procurement 4.0" to denote the digitalization of procurement (Batran et al., 2017; Pellengahr et al., 2016). In Procurement 4.0, the digital and autonomous links within and between companies become the focal point of supply management (Hofmann and Rüsch, 2017). Just as the fourth industrial revolution is reshaping industry, Procurement 4.0 promises to change fundamentally the way buying firms collaborate with their supply network around the globe.

Despite a growing enthusiasm around Procurement 4.0, reality suggests that procurement functions still have a long way to go on their digitalization journey. For example, a pilot study on Procurement 4.0 in Europe showed that over two-thirds of the participating companies had not yet implemented any Procurement 4.0–related applications (Pellengahr et al., 2016, p. 15). To explain and understand the level of professionalism in purchasing and supply management (PSM) organizations, extant PSM literature uses maturity models (Andreasen and Gammelgaard, 2018; Rozemeijer et al., 2003). PSM maturity models aim to describe the process of evolution through different maturity levels or stages (Adams et al., 2016; Andreasen and Gammelgaard, 2018).

However, extant literature on PSM maturity models is limited in helping to explain the digital transformation to Procurement 4.0. First, the substantive domain of traditional PSM maturity models does not account for the more recent trends of *digitalization*. Consequently, while the conceptual dimensions of extant PSM maturity models can be used as a starting point, they need to be re-evaluated to reflect key dimensions of Procurement 4.0, such as information technology (IT) systems and cybersecurity.

Second, extant PSM maturity models usually take the PSM organization as the unit of analysis (Andreasen and Gammelgaard, 2018). However, central to the concept of Procurement 4.0 are the digital and autonomous *links between companies*, which means that a certain level of digitalization maturity is required on both sides of the dyad. Therefore, in a Procurement 4.0 maturity model, the buying firm, its suppliers, and the relationships *between* the different entities must be considered. Such a dyadic perspective also draws attention to the maturity level and heterogeneity of the supply base. Given today's global supply chains, buying firms that want to consistently implement Procurement 4.0 need to establish digital links with all their suppliers, including those in emerging sourcing markets, like China or India. This point is critical because prior research found emerging market suppliers to have a lower maturity level resulting, for example from low IT investments and the use of standalone software (Saldanha et al., 2015).

Third, extant PSM maturity models address *change* as a rather linear and gradual process (Andreasen and Gammelgaard, 2018). However, recent research has started to question the assumption of linear and gradual change and suggests a more evolutionary one (Andreasen and Gammelgaard, 2018). As digitalization radically and rapidly transforms entire industries (e.g., Amazon and Uber), research needs to question how far Procurement 4.0 maturity models follow the traditional linear pattern of change. Especially in more dynamic contexts, like emerging markets or start-ups, the change processes might unfold differently than has traditionally been assumed. Accounting for potentially non-linear change processes could improve the explanatory power of maturity models and help to provide practitioners with better guidance to change.

The general purpose of this paper is therefore to conceptualize and operationalize a maturity model for the digital transformation to Procurement 4.0 by seeking answers to the following specific research questions:

1) How can Procurement 4.0 maturity be *conceptualized*? That is, what are the key dimensions, maturity stages, and change processes in a Procurement 4.0 maturity model?
2) How can Procurement 4.0 maturity be *operationalized* (i.e., empirically measured)?

Guided by Becker et al.'s (2009) procedure for developing maturity models, this paper follows a three-stage approach. In the *conceptualization* phase, we build on theory (via an extensive literature review) and on practice (via an embedded case study with one Western European buying firm and four of its key suppliers in China) to develop the conceptualizations for the Procurement 4.0 maturity model. In the *operationalization* phase, we generate a quantitative measurement instrument by following guidelines from DeVellis (2017) to derive the scale items. In the *validation* phase, we conduct a pre-study with a dyadic sample involving three Western European buying companies, eight of their European suppliers, and seven of their Chinese suppliers to corroborate and refine the model in the field.

This research aims to make three major contributions to the PSM literature. First, it advances the still-embryonic literature on *Procurement 4.0* (e.g., Richey et al., 2016) by extending the content domain of PSM maturity models to digitalization. Second, in contrast to prior PSM maturity models that take the PSM organization as the unit of analysis, this Procurement 4.0 maturity model takes a *dyadic perspective* and accounts for the maturity levels of both buyers and suppliers along several dimensions. Importantly, this perspective sheds light on the crucial role of *co-evolution* between the buyer and the supplier in the digital transformation to Procurement 4.0. Third, this study responds to a recent call by Andreasen and Gammelgaard (2018) to unravel the change processes in PSM maturity models. Instead of conceptualizing change as a rather linear and gradual process, this study finds that *leapfrogging* is a strategy for the digital transformation of procurement that contrasts with the traditional evolutionary process assumed in extant maturity models.

The paper is organized as follows: In the next sections, we review the extant literature, describe the case study methodology, conceptualize and operationalize the Procurement 4.0 maturity model, and present the empirical results from the pre-study. We conclude with a discussion, limitations, and directions for future research.

Literature review for conceptualizing Procurement 4.0 maturity

In the first part of the *conceptualization* phase, we conducted an extensive literature review as a first foundation for the conceptual development of the Procurement 4.0 maturity model (Carter et al., 2017a). First, we searched in academic publishing databases (e.g., ABI/Inform, Elsevier Science Direct, and Emerald Insight) and in Google Scholar using three keyword searches: 1) "procurement 4.0"; 2) "digital" together with "procurement" or "supply management" or "purchasing" or "sourcing"; and 3) "industry 4.0" together with "maturity" as search terms. Second, we conducted a backward and forward search by reviewing the references and "cited by" lists of the retrieved articles to identify additional potential sources. Third, because of the nascent stage of the field (Google Trends indicates that the term "procurement 4.0" first appeared in 2015), we extended our search to include practitioner publications. To identify relevant practitioner publications, we conducted a Google web search using the keywords 1) "procurement 4.0" and 2) "industry 4.0" together with "maturity" as search terms. Fourth, we reviewed the titles, abstracts, and introductory sections of each publication and eliminated the ones that were not related to our research questions. In the following paragraphs, we briefly

review the literature on PSM maturity models before synthesizing the publications on Procurement 4.0.

PSM maturity, defined as "the level of professionalism in purchasing at the business unit level" (Rozemeijer et al., 2003, p. 5), has long been recognized as an important antecedent to firm performance. A key element of PSM maturity models is the proposed process of evolution through different maturity levels or stages (Adams et al., 2016; Andreasen and Gammelgaard, 2018). Several maturity models exist in the PSM literature that assess the level of maturity in the procurement function (e.g., Paulraj et al., 2006) or in more specific areas, such as global sourcing (e.g., Trent and Monczka, 2003). Table 1 provides an overview of existing maturity models. Although these models include some dimensions relevant to Procurement 4.0 maturity (e.g., organizational structure, leadership), their applicability to the field of Procurement 4.0 remains limited because these PSM maturity models insufficiently account for the digitalization aspect (Kleemann and Glas, 2017).

More recently, academics and practitioners began to develop maturity models for Industry 4.0. Most of these models encompass a comprehensive set of dimensions (e.g., technology, organization, people) and evaluate maturity in terms of different levels of development (e.g., newcomers, learners, leaders). Although informative, many of these models are only partly applicable to the specific area of Procurement 4.0 because they do not account for procurement's critical external interface function (Kleemann and Glas, 2017).

Because the field of Procurement 4.0 is still nascent, to the best of our knowledge, no Procurement 4.0 maturity model has been provided to date in the academic, peer-reviewed literature. Starting points can be found primarily in the practitioner literature (e.g., Batran et al., 2017); noteworthy research on the topic has included a pilot study by Pellengahr et al. (2016) that describes the status quo, identifies barriers, and provides recommendations for the digitalization of procurement. Although Pellengahr et al. (2016) do not develop a maturity model, their study lays out a helpful structure of Procurement 4.0 along four dimensions: 1) technologies and systems, 2) organization and processes, 3) management and people, and 4) business models. Furthermore, Kleemann and Glas (2017) have conceptualized a digital maturity model for Procurement 4.0 that covers similar aspects with eight dimensions. Although their practitioner-oriented model accounts for the external interface function of procurement, it is limited to the buying firm's perspective only and offers few details about the conceptual development process.

These works have greatly helped to advance our understanding of Procurement 4.0, but they are still limited in that they assess only the buying-firm side. However, establishing digital links with suppliers requires a certain level of digitalization maturity on both sides of the dyad. Therefore, this paper proposes a Procurement 4.0 maturity model based on a dyadic perspective and compares the maturity levels of both buyers and suppliers along several dimensions. In the following, the maturity model is described in more detail.

Table 1: Existing PSM and Industry 4.0 maturity models

Model name	Source	Type	Methodology	Assessment approach
Purchasing and Supply Management				
Taxonomy of purchasing functions	Cousins et al., 2006	Academic	Empirical (survey)	4 purchasing function configurations based on 4 variables; derived through cluster analysis from a survey of 151 companies

Model name	Source	Type	Methodology	Assessment approach
Levels of strategic purchasing	Paulraj et al., 2006	Academic	Empirical (survey)	Assessment in 3 dimensions, with 11 items to evaluate maturity level in 3 stages; survey of 221 companies
Worldwide sourcing framework	Trent and Monczka, 2003	Academic	Empirical (survey)	Assessment of worldwide sourcing stage in 5 levels; survey of 162 companies
		Procurement 4.0		
Procurement 4.0 framework	Geissbauer et al., 2016	Practitioner	Conceptual	Conceptual development of Procurement 4.0 framework with 6 areas; no details about items and development process offered
Digital maturity model for Procurement 4.0	Kleemann and Glas, 2017	Academic	Conceptual	Conceptual development of questionnaire with 8 dimensions and 24 items to evaluate maturity in 5 stages
Pilot study on Procurement 4.0	Pellengahr et al., 2016	Practitioner	Empirical (expert interviews)	Assessment in 4 dimensions through expert interviews with 27 organizations
		Industry 4.0		
Maturity model for digitalization	Klötzer and Pflaum, 2017	Academic	Conceptual	Assessment in 2 perspectives with 9 dimensions, each to evaluate maturity in 5 levels; no empirical testing
IMPULS—Industry 4.0 readiness	Lichtblau et al., 2015	Practitioner	Empirical (survey)	Assessment in 6 basic dimensions and a total of 18 sub-dimensions with 26 items to indicate readiness in 6 levels; survey with 232 participants
Industry 4.0 / Digital operations self-assessment	PwC, 2016	Practitioner	Empirical (online self-assessment)	Online self-assessment in 6 dimensions; focus on digital maturity in 4 levels; no details about items and development process
Industry 4.0 maturity model	Schumacher et al., 2016	Academic	Empirical (case study)	Assessment in 9 dimensions with 62 items to evaluate maturity; evaluated through two case studies in industrial enterprises

Qualitative study for conceptualizing Procurement 4.0 maturity

In the second part of the *conceptualization* phase, we conducted an embedded case study to assist the conceptual development of the Procurement 4.0 maturity model from practice (Carter et al., 2017a). The embedded case study involves one Western European buying firm and four of its key suppliers in China. The unit of analysis is the buyer–supplier relationship.

Case study setting

China was selected as a particularly information-rich research context for several reasons. First, as the world's manufacturing center, the Chinese supply market has high empirical relevance (Busse et al., 2016). Second, prior studies have reported gaps in technological and managerial capabilities between Western buying firms and Chinese suppliers (e.g, Reimann et al., 2017), which potentially translate into gaps for digitalization maturity as well. Third, China is a very

dynamic market that is currently undergoing digital transformation at a very rapid pace (Woetzel et al., 2017), which makes it an interesting context in which to explore the digitalization of procurement.

Selection of cases

The investigated company, IndustryCo, represents an exemplar case (Pagell and Wu, 2009) because it is a leader in Industry 4.0 and its Chinese factory is recognized as a model factory for Industry 4.0 in China. Given IndustryCo's leading position in Industry 4.0, its top management also shows strong commitment for implementing Procurement 4.0 in its leading Chinese factory. IndustryCo's factory manager explained the overall digitalization strategy:

> With 'Made in China 2025', the Chinese government is really pushing for Industry 4.0 in order to go away from the cheap factory of the world to a more advanced factory in China. We as IndustryCo really want to be a part of this transition. We think with our digitalization that we have here in our factory, we are clearly one of the most advanced factories in China. (Factory Manager, IndustryCo)

The selection of the four key suppliers followed the theoretical sampling principle to enhance external validity and generalizability (Eisenhardt and Graebner, 2007). IndustryCo's Head of Strategic Procurement was asked to identify Chinese key suppliers with which IndustryCo had either successfully implemented digitalization projects or encountered difficulties in implementing digitalization projects (i.e., to identify polar cases). In addition, to provide a contrary replication, IndustryCo was asked to identify one non-Chinese key supplier. Our sample includes four dyadic relationships between IndustryCo and three Chinese key suppliers, as well as one Chinese subsidiary of a Western-based key supplier. Table 3 provides summary information on the case companies.

Table 2: Overview of case study companies

Company[1]	Head-quarters	Revenues (USD)	# Employees	Length of BSR in years	Informant job title(s)	# Inform-ants
IndustryCo[2]	Western Europe	120 million	500	N/A	Factory Manager, Head of Strategic Procurement, Head of Operational Purchasing, Operational Purchaser, IT Manager	10
Electronics-SPL	China	180 million	9,500	5	Key Account Manager	1
Packaging-SPL	China	1 million	45	5	General Manager	1
Plastics-SPL	China	20 million	250	2	Marketing Director	1
Semicon-SPL[3]	United States	13 billion	30,000	5	Key Account Manager	1

[1] Real names are concealed for confidentiality.

[2] Figures relate to the Chinese factory of IndustryCo.

3 Figures relate to Semicon-SPL globally, with IndustryCo sourcing from its local Chinese subsidiary.

Data collection

Data was collected in China through 14 in-depth, semi-structured interviews with both IndustryCo and the suppliers, complemented by documents and on-site visits. Triangulation of data collection methods and sources provides more accurate information from diverse perspectives, thus contributing to stronger construct validity (Eisenhardt, 1989). Our semi-structured interviews ranged from 50 to 90 minutes in duration, with an average of 65 minutes, and they were conducted face-to-face by one of the authors, except for two phone interviews. The interviews were carried out in English or Chinese, depending on the interviewee's preference. All interviews were recorded and transcribed verbatim or were translated as necessary (i.e., from Chinese to English). Table 3 provides further details on the informants.

The semi-structured interview guideline was developed from the extant literatures on Procurement 4.0 and maturity models. It included questions about the organization and digitalization strategy, digitalization initiatives, as well as barriers and enablers for digitalization. To complement the interview data and obtain a more complete understanding of the suppliers' digitalization maturity, we conducted site visits and tours of the production facilities at IndustryCo and two suppliers. In addition, we collected publicly available documents (e.g., annual reports) and company internal documents (e.g., status reports, management presentations) from IndustryCo and the suppliers for the purpose of data triangulation (Eisenhardt, 1989).

Within- and cross-case analyses

During the within-case analysis, case study reports were constructed for each buyer–supplier dyad to draw a rich picture of the digitalization maturity of the case study firms. In the case study reports, we used citations from interviews, photos, and other collected documents to stay close to the original data and to achieve high levels of accuracy (Yin, 2014). To ensure the reliability of our data, the drafts of the case study reports were reviewed by the key informants.

During the cross-case analysis, the findings from the within-case analyses were compared to identify similarities and differences among the four cases (Eisenhardt, 1989). The empirical patterns also were compared and contrasted with extant literature on maturity models to enhance internal and external validity (Gibbert et al., 2008). In the next section, we synthesize our findings from the literature review and the case study analysis to develop the dimensions, maturity stages, and change processes of the Procurement 4.0 maturity model.

Procurement 4.0 maturity model

To conceptualize the dimensions of the Procurement 4.0 maturity model, we synthesized the dimensions used in the extant maturity models (see Table 3) and integrated insights from the case study (see Table 4). Although the number and terminology of dimensions used in the extant literature varies, most maturity models take a holistic perspective that covers strategic, organizational, process-related, and technological areas.

Table 3: Dimensions of Procurement and Industry 4.0 maturity models

Reference	Field	Maturity dimensions terminology
Klötzer and Pflaum, 2017	Industry 4.0	Strategy development, offering to the customer, "smart" product/factory, complementary IT system, cooperation, structural organization, process organization, competencies, innovation culture
Lichtblau et al., 2015	Industry 4.0	Strategy and organization, smart factory, smart operations, smart products, data-driven services, employees
PwC, 2016	Industry 4.0	Digital business models and customer access; digitization of product and service offerings; digitization and integration of vertical and horizontal value chains; data and analytics as core capability; agile IT architecture; compliance, security, legal, and tax; organization, employees, and digital culture
Schumacher et al., 2016	Industry 4.0	Strategy, leadership, customers, products, operations, culture, people, governance, technology
Geissbauer et al., 2016	Procurement 4.0	New procurement value proposition, digital category and service procurement, digital supply chain and supplier management, innovative procurement data use, digital processes and tools, organization, and capabilities
Kleemann and Glas, 2017	Procurement 4.0	Integration, supplier relationships, purchasers, organization, autonomous processes, material group strategy, [digitalization] strategy, company IT

Pellengahr et al., 2016	Procurement 4.0	Technologies and systems, organization and processes, management and people, business models

For our Procurement 4.0 maturity model, we use eight dimensions: leadership, digitalization strategy, organization, skills, IT systems and security, digitalized processes, category strategy, and advanced analytics. We define and explain the rationale for each dimension in more detail in the following paragraphs, while acknowledging that the dimensions partly overlap. We do so from the buying-firm perspective.

Leadership. The leadership dimension pertains to the top managers' support for digitalization in the company overall and in procurement in particular. The PSM literature recognizes that top management support is a critical enabler for strategic procurement initiatives because top management can devote financial and personnel resources toward the procurement function (Cousins et al., 2006). Likewise, practitioners emphasize the value of leadership for driving the digitalization of procurement (Batran et al., 2017; Pellengahr et al., 2016). For example, a manager at Airbus Defence & Space emphasizes the importance of leadership for the digital transformation of procurement: "Leaders and managers should also take sponsorship of proofs of concept and digital innovation projects […] and 'speak' the language of digital" (Batran et al., 2017, p. 116).

Digitalization strategy. The strategy dimension captures the degree to which a digitalization strategy for procurement exists and the degree to which procurement's digitalization strategy is aligned with the company's digitalization strategy. Because digitalization can strongly affect procurement's value proposition and contribute to the development of new business models, the procurement strategy should set priorities for the implementation of Procurement 4.0 (Kleemann and Glas, 2017; Pellengahr et al., 2016). Kleemann and Glas (2017) further emphasize that a Procurement 4.0 strategy should be derived from and aligned with the company's overall digitalization strategy. The case study revealed IndustryCo's strong commitment to digitalization. During the case study interviews, IndustryCo frequently emphasized the strategic importance of digitalizing procurement, although no formalized digitalization strategy for procurement existed at the time of data collection:

> Today one supply chain is competing with another supply chain. So you have to integrate the partners in your supply chain—your manufacturing, your suppliers, your suppliers' suppliers—all by using digitalization to make sure to integrate these partners to produce efficiently and to respond flexibly to the customers' needs. (Head of Strategic Procurement, IndustryCo)

Organization. The organization dimension includes the roles, responsibilities, and interfaces for the coordination and integration of Procurement 4.0 within the company and with external partners. Coordination and integration can be achieved through vertical mechanisms (e.g., centralized chief digital officer) or through lateral mechanisms (e.g., decentralized cross-functional teams) (Trautmann et al., 2009). Kleemann and Glas (2017) conclude that central coordination through a function like a chief digital officer can be useful and suggest that, because of its interface function, procurement should be a driver of cross-functional coordination. Although IndustryCo employs a chief digital officer at the business unit level, at the time of data collection it did not have dedicated roles and responsibilities for digitalization in the procurement function. However, during follow-up calls, the Head of Operational Purchasing mentioned that IndustryCo recently had decided to create a dedicated position for digitalization in the procurement function.

Skills. The skills dimension describes the digital skills and competencies of procurement professionals. Most studies agree that Procurement 4.0 requires a very different skill set from procurement managers, in the dimensions of both "how to buy" and "what to buy" (Batran et al., 2017). Regarding the "how to buy" dimension, current job profiles are likely to evolve to include more strategic tasks as technologies such as robotic process automation increasingly automate routine operational processes (Pellengahr et al., 2016). This change requires that procurement professionals possess profound IT and process know-how to coordinate automated processes (Kleemann and Glas, 2017). Furthermore, new job profiles, such as data scientists or big data specialists, will be required for the digital transformation of procurement (Geissbauer et al., 2016). Regarding the "what to buy" dimension, job profiles will extend to new digital purchase items, such as virtual reality or artificial intelligence solutions (Geissbauer et al., 2016).

IT systems and security. This dimension includes the company's IT systems, as well as IT security and risk management (Kleemann and Glas, 2017). The Gartner IT Glossary defines IT as "the entire spectrum of technologies for information processing, including software, hardware, communications technologies, and related services" (Gartner, 2018). Because IT is the backbone for any digital solution (Lichtblau et al., 2015), the procurement function should have access to IT resources to implement and upgrade integrated digital tools and processes. In addition, IT security measures are critical for mitigating data and IT security risks associated with cybercrime, such as the cyberattack that hit several global companies (e.g., Beiersdorf, Merck, Reckitt Benckiser) and the Ukraine government in June 2017 *(Financial Times*, 2017). In their pilot study on Procurement 4.0, Pellengahr et al. (2016) find that sufficient data protection and IT security are among the most important requirements for the implementation of Procurement 4.0.

Digitalized processes. This dimension relates to the aspect of "how to buy" (Batran et al., 2017) and encompasses the end-to-end procurement process. This process can conceptually be broken down into a source-to-contract (S2C) phase, ranging from the start of the sourcing process to the award of the contract, and a purchase-to-pay (P2P) phase, ranging from the point of order to the payment. At present, dozens of software solutions are available on the market for the digitalization and automation of strategic and operational procurement processes, and technologies like robotic process automation (RPA) promise to automate even more tasks (McKinsey, 2018). To automate the P2P process, IndustryCo had implemented a P2P software and intended to establish classic EDI or WebEDI integration with its Chinese suppliers.

Category strategy. This dimension concerns the aspects of "what to buy" and encompasses the category strategies for digital products and services (e.g., apps and software for connected driving), as well as the search for digital innovations (e.g., from startups) (Batran et al., 2017). Kleemann and Glas (2017) illustrate how companies need to create strategies for new categories (e.g., a machine manufacturer needs to purchase a touchpad, including software, for its machines) and need to adjust existing category strategies (e.g., 3D-printing changes the category strategies for spare parts). With its internal and external interface functions, procurement increasingly becomes an important radar for identifying innovations from current and future suppliers in the supply ecosystem (BME e.V., 2018).

Advanced analytics. This dimension describes procurement's ability to analyze the data that runs between a buying company and its suppliers. Digitalization is generating Big Data—that is, "structured and unstructured relationship-based information that is unique to business because of its volume, velocity, variety, and veracity" (Richey et al., 2016, p. 720). Volume refers to the total amount of data generated, velocity to the increasing speed of data creation, variety to the multiple types of data that are created, and veracity to the changes in data that occur

during and following collection that influence the data's usefulness (Richey et al., 2016). Practitioners expect procurement to tap new sources of value by analyzing these data via advanced analytics tools (McKinsey, 2018)—for example, through pay-per-use contracting models or artificial intelligence-based forecasting procedures.

Table 4: Illustrative quotes on maturity dimensions

#	Dimension	Illustrative quotes from case study
1	Leadership	"Why is our attention toward IT not developed? This depends on where the boss puts his emphasis with regards to the company's development. For example, because labor costs might be too cheap, the boss does not want to invest a lot of money in an IT system. So this concept of EDI [electronic data interchange] first needs to get into the heart of the boss." (Key Account Manager, Electronics-SPL)
2	Digitalization Strategy	"At IndustryCo, we have high attention, on the one hand, to drive ourselves to use the digitalization tools—for example, data exchange between us and the supplier. We also, on the other hand, encourage our suppliers to invest in these digitalization solutions to make sure that the two companies can exchange information very quickly. In general, our procurement strategy for digitalization is trying to digitalize the manual work and make sure that the information is more efficient. This is the direction we want to drive by using a lot of tools, internally and externally." (Head of Strategic Procurement, IndustryCo)
3	Organization	"During a town hall meeting, we have recently discussed what we understand by digitalization.… We are now planning to have a procurement employee who dedicates part of her work time to digitalization and who can coordinate digitalization initiatives in procurement." (Head of Operational Purchasing, IndustryCo, follow-up call)
4	Skills	"The reason why we did not implement EDI [with Packaging-SPL] lies mainly at the supplier side because its employees cannot handle our data very efficiently if we send the EDI data to them. So we would have to teach them how to understand our EDI data. So they replied to us that they hoped to choose the traditional method to handle our purchase orders, by Excel and by email communication." (Operational Purchaser, IndustryCo)
5	IT systems and security	"Most local [Chinese] suppliers, maybe 90%, use some kind of ERP [enterprise resource planning] system for their internal order processing. But they might all use different systems [e.g., Kingdee, Yonyou]—not only SAP. We also have a few local suppliers who use a rather 'local' method to process the orders via Excel. Some suppliers might have the necessary system infrastructure, but they might not want to use EDI with you because the setup effort is too big." (Operational Purchaser, IndustryCo)
6	Digitalized processes	"We are a digital factory; we require suppliers to use EDI. We also consider this when we assign future orders.… Plastics-SPL is a new supplier who has a strong willingness to do business with us, so it is easier to implement EDI with this supplier than compared with other suppliers." (Operational Purchaser, IndustryCo)
7	Category strategy	As a leading producer for smart products associated with Industry 4.0, IndustryCo also purchases several IT-related material categories, such as printed circuit boards sourced from Electronics-SPL or semiconductors sourced from Semicon-SPL.
8	Advanced analytics	"We must make sure that the information from our customers goes through the whole supply chain quickly, and in real time. It must be a very efficient information transfer if we want to make sure that our whole supply chain responds very quickly. We expect suppliers to have the capability and willingness to cooperate with us—for example, on EDI solutions, the forecast, VMI. All these tools aim to make sure that all the information from our customers to our supply chain can move very fast." (Head of Strategic Procurement, IndustryCo)

Procurement 4.0 centers around the digital and autonomous links *between* companies, which means that a certain level of digitalization maturity is required on both sides of the dyad. Findings from the case study reveal that the digital transformation of procurement at IndustryCo was partly impeded by the digital maturity level of its suppliers. IndustryCo's Head of Strategic Procurement explained that the heterogeneity of the supply base in China represented a challenge for digitalization:

> Our supply base is quite varied, our suppliers are not all on the same level. We have world-class suppliers like Semicon-SPL. We do not need to teach these companies about digitalization. All you need to do with these world-class suppliers is to coordinate, discuss, find a win-win situation, and align which tools to implement and what kind of information to share. For the middle-sized and the low-end suppliers, we also need to promote digitalization, to educate them on the benefits for them. (Head of Strategic Procurement, IndustryCo)

Incorporating a dyadic perspective in the Procurement 4.0 maturity model therefore implies assessing the digitalization maturity of suppliers as well. To do so, the maturity model should cover the same eight dimensions as it does for the supplier's digitalization maturity. Appendix A shows the detailed items for the supplier perspective. Taken together, the two perspectives of the dyadic model allow us to compare the digitalization maturity of buyers and suppliers.

Maturity model stages

With each of the maturity dimensions defined, our next step was the conceptualization of different maturity *levels* or *stages* that constitute PSM maturity models (Adams et al., 2016; Andreasen and Gammelgaard, 2018). Maturity stages can either be conceptualized ex ante from theory (e.g., Kleemann and Glas, 2017) or derived ex post/empirically—for example, through cluster analysis from survey data (e.g., Adams et al., 2016; Paulraj et al., 2006). The present paper follows the former approach in that it conceptually derives maturity stages based on extant literature (see Table 1). Building on typical PSM maturity stages (Andreasen and Gammelgaard, 2018), we propose a five-stage model in which the initial stage is characterized by the absence of digital procurement and intermediary stages move toward the final stage of fully digitalized procurement. In labeling the stages, we adopt the terminology of more recent Industry 4.0 maturity models (e.g., Lichtblau et al., 2015; PricewaterhouseCoopers, 2016a):

- **Digital outsider** (Stage 1): Firms in this group are in the traditional stage of procurement. Digital outsiders have not yet started the digital transformation of procurement and do not have concrete plans for pilot initiatives.
- **Digital newcomer** (Stage 2): Firms in this group are in the nascent stage of digitalization. Digital newcomers have done either very little or are currently planning pilot initiatives in a few selected areas and with a limited number of suppliers.
- **Developing learner** (Stage 3): Firms in this group are in the developing stage, working toward the digital transformation of procurement. Developing learners are currently implementing pilot projects in some areas and with several selected suppliers.
- **Seasoned expert** (Stage 4): Firms in this group are in an advanced stage on the road to the digital transformation of procurement. Seasoned experts have already implemented digitalization initiatives in several key areas and with the majority of their supply base.
- **Digital champion** (Stage 5): Firms in this group are leading the digital transformation of procurement. Digital champions have comprehensively implemented digital initiatives in all relevant areas and across their supply base.

These five stages are detailed for each of the eight Procurement 4.0 dimensions in Appendix B. In the following section, we discuss potential change processes through the maturity stages.

Change processes through maturity stages

Linear evolution. Extant PSM maturity models address *change* through the maturity stages as a rather linear and gradual process (Andreasen and Gammelgaard, 2018). This model of a linear evolution process conjectures that reaching one maturity stage is the foundation for moving to

the next stage (Andreasen and Gammelgaard, 2018). In line with extant literature, our Procurement 4.0 maturity model views linear evolution as the standard development path. However, departing from extant PSM maturity models, the proposed Procurement 4.0 maturity model also considers co-evolution and leapfrogging as alternative development trajectories.

Co-evolution. The concept of co-evolution recognizes that the buyer's and the suppliers' digitalization maturity each develop as distinct but mutually intertwined co-evolutionary processes, where each conditions the other's evolution (Kaufmann et al., 2016). This concept is inherently dyadic in nature and suggests in our case that the digital transformation of procurement requires both the buyer and suppliers to possess and progress through specific levels of digitalization maturity. In the case study, IndustryCo's management recognized that digitalization could not stop at the factory walls; it needed to include suppliers to deliver its full benefits. The Factory Manager explained:

> I think purchasing is really important because about 70% of our product costs are purchasing spend. So if you want to be successful, if you really want to digitalize, clearly also the entire supply chain has to follow the same way. It is not working if only we are digitalized but then there is a break to our suppliers. From my point of view, the supply base also has to upgrade to the same level.… Clearly, procurement is playing one of the important roles to… really bring digitalization to the suppliers in the next years. (Factory Manager, IndustryCo)

How the buyer's development pace relates to the pace of the supplier plays a critical role in the notion of co-evolution. In the case study, the Head of Strategic Procurement suggested that the buyer would need to adjust its digitalization pace to that of the supply base:

> IndustryCo is not independent from its environment, from the city in which it is located, from China. You cannot be ten years ahead of others; then you could not integrate with suppliers. I think the best companies are three or five years ahead; then you can get the most advantages. But you cannot be successful if you are too quick. (Head of Strategic Procurement, IndustryCo)

Leapfrogging. The concept of leapfrogging recognizes that companies can skip certain intermediary stages in the digital maturity model and move directly to a higher maturity stage. This notion departs from prior PSM maturity models that conceptualize change as linear and consider the skipping of stages to be an exception (Andreasen and Gammelgaard, 2018). In the emerging market context of the case study, leapfrogging appeared to be particularly relevant for small and medium-sized suppliers, as IndustryCo's Head of Strategic Procurement explained:

> The small and medium-sized suppliers, which we now promote and educate on digitalization, might skip one step. For example, they might not build their own data centers but directly go to cloud technologies. I think this is something that they can skip, they can always learn from the newest technology. (Head of Strategic Procurement, IndustryCo)

Plastics-SPL did not even have an ERP system until 2016 and recently adopted WebEDI with IndustryCo. The case suggests that leapfrogging across stages of technological development might be a viable option for Chinese suppliers. Similar to the way China's businesses leapfrogged from using cash to using mobile payment technologies, a leapfrogging strategy could mean that Chinese suppliers upgrade from Industry 2.0 directly to Industry 4.0. IndustryCo's Head of Strategic Procurement illustrated this logic with an example from the automotive industry:

> The Chinese automotive manufacturers do not want to follow the gradual development path because if they follow this, they will always be the follower. So they want to use the chances provided by technological innovation to immediately address the opportunity to go to the next stage—for example, through robotics solutions and customization. Now this area of customization is new to everybody; it is new not only to China but also to European industrialized countries. If we follow and go to mass production, we cannot do it better than the predecessor. (Head of Strategic Procurement, IndustryCo)

For Procurement 4.0, this reasoning could imply that Chinese suppliers—without the burden of legacy ERP systems—can quickly adopt cloud-based ERP solutions or mobile applications for digital integration with their customers. In addition, leapfrogging might be practiced not only by suppliers but also by buying organizations; specifically, start-ups typically skip various maturity stages by nature.

Operationalizing the Procurement 4.0 maturity model

In developing our scale items, we followed the guidelines from DeVellis (2017). We generated multiple items to ensure item reliability and avoided lengthy items to prevent complexity and ambiguity. To increase response differentiation, we adopted a 7-point Likert-type scale as the response format (Carter et al., 2017a). We also used items from existing scales developed by Kleemann and Glas (2017) to provide a solid theoretical foundation.

In a pretest, the item pool was assessed by three supply management experts, each with more than 10 years of experience in strategic procurement and extensive knowledge about Procurement 4.0 (DeVellis, 2017). The experts were instructed to rate the item applicability to the Procurement 4.0 context and to evaluate item wording (e.g., content validity and face validity) to avoid ambiguity (Min and Mentzer, 2004). Based on the feedback, we eliminated or reworded some of the items and added others. The final item pool consists of 31 items and is shown in Appendix A.

Quantitative pre-study for validating the Procurement 4.0 maturity model

To corroborate and refine the model in the field, we conducted a pre-study and collected feedback for further improvements (Schumacher et al., 2016). In this pre-study, the Procurement 4.0 maturity measurement instrument was administered to a dyadic sample of three Western European buying companies, eight of their European suppliers, and seven of their Chinese suppliers.

Sample and data collection

The buying firm sample covered leading manufacturing companies from the automotive, industrial automation, and household appliances sectors. The selected buying firms were already engaged in Procurement 4.0 to varying degrees, thus ensuring that they had the requisite knowledge and understanding about its basic concepts (Schumacher et al., 2016). Each buying firm was asked to identify three to five key suppliers, including both medium-sized and large European suppliers, as well as Chinese suppliers.

Data collection was conducted via an online survey, with responses to the 31 items captured on a seven-point Likert-type scale. Respondents were procurement managers (for buying firms) and sales managers (for suppliers). On average, buying firm respondents rated their knowledge about Procurement 4.0 at 5.8 on the 7-point scale, whereas supplier respondents rated their knowledge about digitalization at 3.8. The number of employees ranged from 20,000 to 300,000

for buying firms and from 50 to 30,000 for suppliers. (The average size of suppliers was about 7,500 employees.)

Pre-study results

The pre-study results show that Western European buying firms rate their Procurement 4.0 maturity at an average value of 5.1 on a 7-point Likert-type scale across all dimensions. Chinese suppliers rate their maturity somewhat higher (mean of 5.5), and European suppliers somewhat lower (mean of 4.6) than the Western buying firms. A similar pattern was seen for the individual maturity dimensions, except that in the "Leadership" dimension, the buying firms showed the highest value. (Because of the low sample size thus far, we caution readers to avoid drawing concrete conclusions from the pre-study results.) Figure 1 visualizes the maturity along all eight dimensions using a radar chart.

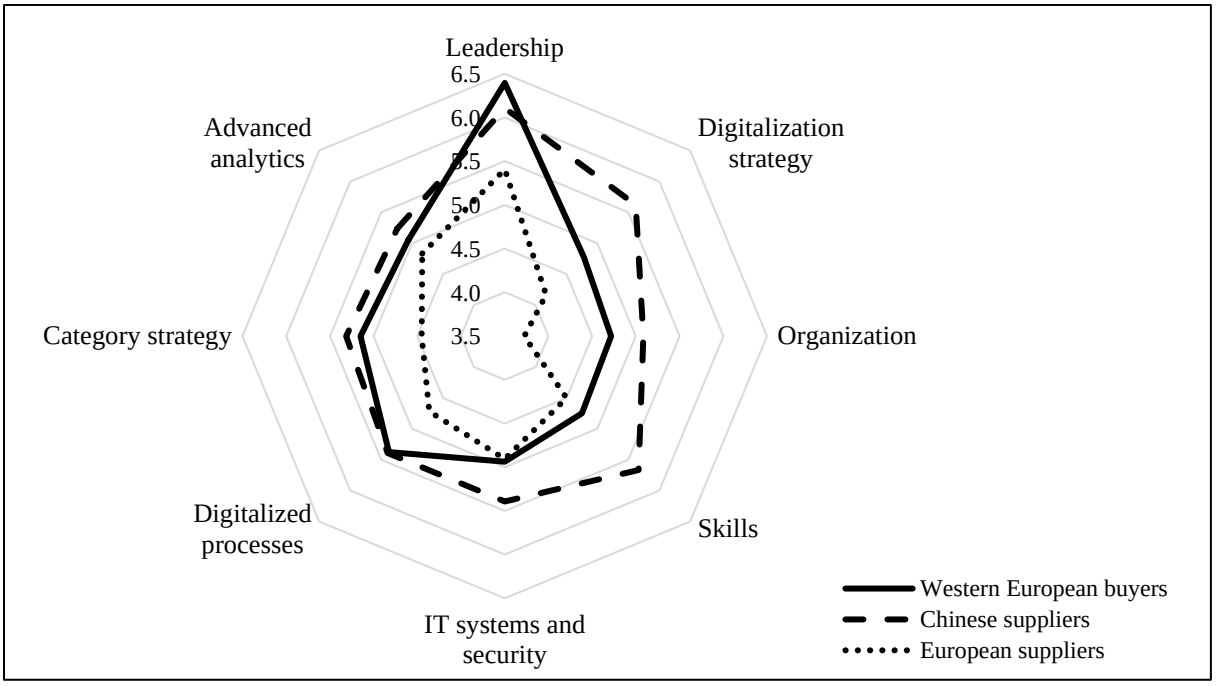

Figure 1: Radar chart visualizing Procurement 4.0 maturity in eight dimensions

To corroborate and refine the model, we presented the pre-study results to the assessed companies and collected feedback for further improvements (Schumacher et al., 2016). The clarity of the questionnaire items, the applicability and relevance of the Procurement 4.0 model, and its visual representation using radar charts received positive feedback throughout. The feedback from practitioners and further analysis of the pre-study by the research team informed the identification of potential areas for further developments, which are discussed in the next section.

Discussion and conclusion

Our research aimed to provide initial answers to two research questions. The first was to conceptualize a Procurement 4.0 maturity model. Building on a literature review and a case study, we derived eight dimensions, five maturity stages, and possible change processes. The second research question was to operationalize the Procurement 4.0 maturity model. To this end, we developed 31 items and administered a quantitative pre-study to a dyadic sample of 18 companies: 3 Western European buying firms, 8 of their European suppliers, and 7 of their Chinese suppliers.

Theoretical contributions

This research aims to make three major contributions to the PSM literature. First, it advances the still-embryonic literature on *Procurement 4.0* (e.g., Richey et al., 2016) by extending the content domain of PSM maturity models to digitalization. Although researchers and practitioners are still discussing the specific delineation of Procurement 4.0, that the digitalization of procurement offers the potential to fundamentally change the way buying firms collaborate with their supply network around the globe is undisputed (Hofmann and Rüsch, 2017). By conceptualizing eight dimensions of Procurement 4.0 maturity, our research offers an initial step toward better grasping the concept of Procurement 4.0 as it unfolds in practice.

Second, in contrast to prior PSM maturity models that take the PSM organization as the unit of analysis, this Procurement 4.0 maturity model takes a *dyadic perspective* and accounts for the maturity levels of both buyers and suppliers along several dimensions. A dyadic perspective is particularly relevant in the PSM context because critical technologies and processes for the digitalization of procurement span organizational boundaries (Liu et al., 2016; Saldanha et al., 2015). To maximize relational performance in supply chains (Carter et al., 2017b), research and practice should therefore consider both the buying firm's and the supplier's perspective. Importantly, this dyadic perspective sheds light on the crucial role of *co-evolution* between the buyer and the supplier in the digital transformation to Procurement 4.0.

Third, this study responds to a recent call by Andreasen and Gammelgaard (2018) to unravel the change processes in PSM maturity models. Instead of conceptualizing change as a rather linear and gradual process, this paper offers *leapfrogging* as a strategy particularly suitable for the digital transformation of procurement—one that contrasts with the traditional evolutionary process assumed in extant maturity models. Accounting for non-linear change processes can improve the explanatory power of maturity models and helps to provide practitioners with better guidance for change.

Managerial implications

Interest in the topic of Procurement 4.0 is growing among practitioners, and many remain confused about what the digitalization of procurement means for their business. However, extant PSM research to date offers very little guidance for managers concerning the digital transformation to Procurement 4.0. Our Procurement 4.0 maturity model aims to provide managers with initial guidance for analyzing their own and their supply base's status on the road toward Procurement 4.0—guidance that is grounded in theory and based on empirical findings. The maturity model suggests that managers should take a holistic approach, considering several maturity dimensions that range from leadership to skills to advanced analytics. Importantly, managers should develop their Procurement 4.0 roadmaps with an eye toward the digitalization maturity of their supply base so that they co-evolve together with their supply network. Companies in an early digital maturity stage might devise ways to skip or leapfrog over intermediary stages to reach a desired maturity level.

Limitations and future research

We acknowledge three limitations inherent in the exploratory nature of our study, which provide many opportunities for future research. First, the Procurement 4.0 maturity model so far takes a one-size-fits-all approach and does not differentiate among the different strategic priorities of companies. However, the digitalization profile of a company needs to fit its strategic priorities (e.g., savings, innovation, speed, agility, or risk mitigation). Future research could adopt a neo-configurational perspective (Kosmol et al., 2018) and analyze which configurations of digitalization maturity support the achievement of different strategic priorities.

Second, the somewhat surprising finding that emerging market suppliers show a higher digitalization maturity than suppliers from developed markets could be attributed to problems associated with the self-assessment method used. Although administering online surveys is less time-consuming and can reach a larger sample size than case studies, self-assessments might not accurately reflect the actual maturity level of respondents. Therefore, a methodological implication from our quantitative pre-study might be that researchers should administer their maturity assessment using on-site personal interviews or conduct on-site audits to achieve higher validity.

Third, our focus on manufacturing companies and the small sample size limit the generalizability of our results. Thus, we call for future research to replicate this study with a larger sample covering different kinds of industries.

Finally, our study provides only an initial starting point for further research in this exciting area. Because of the nascent stage of the field and the ongoing development of digitalization, many unanswered questions remain. In Table 5 we therefore suggest a comprehensive agenda for future research on Procurement 4.0 using the "5Ws and H" approach (Cao and Lumineau, 2015).

Table 5: Proposed research agenda

	What? **Area to Investigate**	**Who?** **Actors**	**Where?** **Contextual Variables**	**When?** **Temporal Variables**	**Why?** **Relevance**	**How?** **Managerial Interventions**
Key concepts	**Topic area:** psychological, social, behavioral, and structural factors **Situational factors:** barriers and enablers; type of supply chain technology	**Individual-level:** personality traits **Organization-level:** company type, power **Network-level:** associations, network effects	**Contextual factors:** institutional environment, national culture, environmental dynamism, supply network structure, industry sector	**Temporal factors:** maturity stage, technology adoption process, timing of technology implementation (early vs. late), leapfrogging	Why is it important to investigate this area? What are the outcomes and consequences of Procurement 4.0?	Measures to influence the digitalization of procurement
Possible research questions	• What key performance indicators exist to measure the dimensions of Procurement 4.0 maturity? • What barriers and enablers exist in the digitalization of procurement? • Which factors determine why some companies show higher digitalization maturity than others? • Do different types of information technologies lead to differences in supply chain integration?	• How do personality traits of company owners and top managers influence whether suppliers adopt digital technologies or not? • How do Internet companies and start-ups in the ecosystem influence the digitalization of procurement? • Which skill profiles are required from procurement managers for the digital transformation of procurement?	• How do companies mitigate institutional voids (e.g., unstable Internet connectivity) in the IT ecosystem of emerging markets? • How do government interventions (e.g., Great Firewall of China) moderate cross-border data flows in supply chains? • How do cultural and institutional factors moderate digital supplier integration? • How does network structure influence the digitalization in supply networks?	• How do companies evolve through the Procurement 4.0 maturity stages over time? • Which patterns of co-evolution exist in buyer–supplier dyads? • How do the digitalization strategies of early adopters and latecomers in Procurement 4.0 differ? • How does the adoption of IT spread across different tiers in supply chains over time?	• What are the operational, financial, and strategic performance outcomes of Procurement 4.0? • Which configurations of digitalization maturity are associated with the achievement of different strategic priorities? • Does the "IT productivity paradox" also occur for Procurement 4.0? • What are the short-term and long-term effects of the digital transformation of procurement?	• How can CPOs increase their company's Procurement 4.0 maturity? • Which mitigation strategies reduce barriers to the digitalization of procurement? • How can buying firms incentivize suppliers to invest in digital integration capabilities? • How can industry associations promote the standardization and interoperability of IT systems?
Promising theories	Socio-structural view, organizational inertia	Dynamic capabilities, network effect theory	Technology-organization-environment framework	Complex adaptive systems theory, event system theory	IT productivity paradox, supply chain practice view	Supply chain practice view, game theory

Suggested methodologies	Survey research, multiple case studies	Experiments, case studies, network analyses	Survey research, case studies	Process studies, simulations	Survey research, big data analytics, data envelopment analysis	Field experiments, action research

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Appendix

Appendix A: Dimensions and items of Procurement 4.0 maturity model

#	Dimension	Abbreviated description[1]	Items (Buying companies)[2]	Items (Suppliers)[2]
1	Leadership	Top management support	Industry 4.0 and digitalization are highly valued in our company as a whole.	Industry 4.0 and digitalization are highly valued in our company as a whole.
2	Leadership	Digitalization strategy	A comprehensive digitalization strategy exists for our company as a whole.	A comprehensive digitalization strategy exists for our company as a whole.
3	Leadership	Top management knowledge and awareness	Our senior management is fully knowledgeable and aware of the importance, workings, and implications of Procurement 4.0.	Our senior management is fully knowledgeable and aware of the importance, workings, and implications of digitalization.
4	Leadership	Digitalization support	Our senior management fully supports Procurement 4.0 projects.	Our senior management fully supports digitalization projects.
5	Digitalization strategy	Digitalization guidelines	There are clear guidelines and priorities indicating how digital Procurement 4.0 should contribute to our company.	There are clear guidelines and priorities indicating how digitalization should contribute to our company.
6	Digitalization strategy	Digitalization concept	A comprehensive, up-to-date concept for digital integration with suppliers guides our strategic supplier management activities.	A comprehensive, up-to-date concept for digital integration with customers guides our strategic customer management activities.
7	Digitalization strategy	Functional influence	The procurement function regularly uses its market and supplier know-how to actively influence our company's digitalization strategy (e.g., procurement of innovations and Industry 4.0 technologies).	The sales function regularly uses its market and customer know-how to actively influence our company's digitalization strategy (e.g., data-driven services and Industry 4.0 technologies).
8	Organization	Central coordination	Digitalization projects in our company are centrally coordinated (e.g., through a "Chief Digital Officer").	Digitalization projects in our company are centrally coordinated (e.g., through a "Chief Digital Officer").
9	Organization	Roles and responsibilities	Clear and dedicated roles and responsibilities for the management of digitalization in the procurement function exist, such as a "Digital Procurement Manager."	Clear and dedicated roles and responsibilities for the management of digitalization exist in our company, such as a "Digital Sales Manager."
10	Organization	Cross-functional teams	Digitalization projects in the procurement function are often realized in cross-functional teams.	Digitalization projects are often realized in cross-functional teams.
11	Organization	External partners	Digitalization projects in the procurement function are often realized with external partners (e.g., consultants, start-ups, academia).	Digitalization projects are often realized with external partners (e.g., consultants, start-ups, academia).

#	Dimension	Abbreviated description[1]	Items (Buying companies)[2]	Items (Suppliers)[2]
12	Organization	Resources	The procurement function has sufficient resources dedicated to working on digitalization topics in the ordinary course of business.	Our company has sufficient resources dedicated to working on digitalization topics in the ordinary course of business.
13	Skills	Digital expertise	Building up functional digital expertise quickly is a core element of employee development in the procurement function.	Building up functional digital expertise quickly is a core element of employee development in our company.
14	Skills	Digital tool skills	Our procurement staff are very skilled in the use of our digital tools and processes.	Our staff are very skilled in the use of our digital tools and processes.
15	Skills	Recruitment criterion	Functional digital competencies are an important selection criterion in the recruitment of new procurement employees.	Functional digital competencies are an important selection criterion in the recruitment of new employees.
16	IT systems and security	IT updates	Our enterprise IT is updated regularly and promptly to meet new challenges.	Our enterprise IT is updated regularly and promptly to meet new challenges.
17	IT systems and security	IT resources	We have sufficient access to IT resources (e.g., software developers, IT specialists) for digitalization projects in procurement.	We have sufficient access to IT resources (e.g., software developers, IT specialists) for digitalization projects.
18	IT systems and security	Data & IT security	Data and IT security are strictly ensured through risk analyses and risk mitigation measures.	Data and IT security are strictly ensured through risk analyses and risk mitigation measures.
19	IT systems and security	Procurement/ order data	Our company has an IT system that gathers procurement data seamlessly and enables quick interpretation of that data.	Our company has an IT system that gathers order data seamlessly and enables quick interpretation of that data.
20	Digitalized processes	Internal collaboration	The procurement function frequently uses digital collaboration and knowledge exchange platforms internally.	Our company frequently uses digital collaboration and knowledge exchange platforms internally.
21	Digitalized processes	External collaboration	We regularly use digital collaboration platforms with suppliers.	We regularly use digital collaboration platforms with customers.
22	Digitalized processes	Automatic purchase orders	The workflow for regular purchase orders runs automatically within defined parameters – without human intervention (e.g., order release, control).	The workflow for regular sales orders runs automatically within defined parameters – without human intervention (e.g., order confirmation, shipment notification).
23	Digitalized processes	End-to-end supply chain	We enthusiastically drive digitalization projects with our suppliers (e.g., real-time sharing of production data, seamless drawings exchange) to move toward an integrated, end-to-end supply chain.	We enthusiastically drive digitalization projects with our customers (e.g., real-time availability of production data, seamless drawings exchange) to move toward an integrated, end-to-end supply chain.
24	Category strategy	Supplier/ customer segmentation	We regularly segment and evaluate supplier relationships in terms of their digitalization potential (e.g., EDI links).	We regularly segment and evaluate customer relationships in terms of their digitalization potential (e.g., EDI linkages).

#	Dimension	Abbreviated description[1]	Items (Buying companies)[2]	Items (Suppliers)[2]
25	Category strategy	Strategic alignment	We frequently discuss digital modes of collaboration with our suppliers (e.g., digitalization roadmaps) to achieve strategic alignment in the area of digitalization.	We frequently discuss digital modes of collaboration with our customers (e.g., digitalization roadmaps) to achieve strategic alignment in the area of digitalization.
26	Category strategy	Digital categories	We use material categories and up-to-date category strategies for the procurement of a wide range of digital goods and services (e.g., intelligent sensors, software, CAD drawings).	We use product categories and up-to-date product management strategies for a wide range of digital solutions and services (e.g., customized products, predictive maintenance, online customer support).
27	Category strategy	Technology impact	Our procurement function regularly analyzes the effects of new technologies (e.g., 3D-printing, blockchain technology) on the make-or-buy decision.	We regularly analyze the effects of new technologies (e.g., 3D-printing, customer analytics) on our strategy.
28	Category strategy	Innovation radar	Our procurement function proactively looks for suppliers and products in the area of new, innovative technologies to anticipate changing requirements.	We proactively look for solutions and products in the area of new, innovative technologies to anticipate changing demands.
29	Advanced analytics	Big data analytics	We widely use software to automatically analyze critical parameters, like inventory range, procurement spend, order frequency, and raw material prices (i.e., Big Data Analytics).	We widely use software to automatically analyze critical parameters, like inventory range, sales volume, order frequency, and customer satisfaction (i.e., Big Data Analytics)
30	Advanced analytics	Predictive analytics	We widely use automated, real-time analyses to trigger forecast-based orders (predictive analytics).	We widely use automated, real-time analyses to trigger forecast-based production (predictive analytics).
31	Advanced analytics	Innovative contracting	Our procurement function proactively analyzes the viability of innovative contracting models for digital services (e.g., pay-per-use, performance-based contracting).	We proactively analyze the viability of innovative contracting models for digital services (e.g., pay-per-use, performance-based contracting).

[1] P4.0 = Procurement 4.0
[2] All items are measured on a seven-point Likert-type scale ranging from 1 = strongly disagree to 7 = strongly agree.

Appendix B: Overview of maturity stages

Dimension	**Digital outsider** (Stage 1)	**Digital newcomer** (Stage 2)	**Developing learner** (Stage 3)	**Seasoned expert** (Stage 4)	**Digital champion** (Stage 5)
Leadership	Digitalization is not incorporated in the company's strategy. Top management shows no or very limited knowledge or support for digitalization in the company and in the procurement function.	Digitalization is only starting to be incorporated in the company's strategy. Top management shows limited knowledge and support for digitalization in the company and in the procurement function.	Digitalization is largely being incorporated in the company's strategy. Top management shows basic knowledge and support for digitalization in the company and in the procurement function.	Digitalization is incorporated in the company's strategy. Top management shows extensive knowledge and support for digitalization in the company and in the procurement function.	Digitalization is firmly incorporated in the company's strategy. Top management shows very strong knowledge and support for digitalization in the company and in the procurement function.
Digitalization strategy	No digitalization strategy exists for the company. No Procurement 4.0 concept exists.	Procurement has no or only very limited influence on the company's digitalization strategy. Selective elements of a Procurement 4.0 concept are starting to be developed.	Procurement has limited influence on the company's digitalization strategy. A comprehensive Procurement 4.0 concept is being developed.	Procurement has considerable influence on the company's digitalization strategy. A comprehensive Procurement 4.0 concept exists and is selectively used.	Procurement has major influence on the company's digitalization strategy. A comprehensive Procurement 4.0 concept exists and is being implemented throughout the company
Organization	No roles and responsibilities for the coordination of Procurement 4.0 within the company or with external partners have been assigned.	Roles and responsibilities for the coordination of Procurement 4.0 within the company and with external partners are starting to be designated.	Roles and responsibilities for the coordination of Procurement 4.0 within the company and with external partners are selectively being implemented.	Clear roles and responsibilities for the coordination of Procurement 4.0 within the company and with external partners exist (e.g., Digital Procurement Officer).	Clear roles and responsibilities for the coordination of Procurement 4.0 within the company and with external partners are established throughout the company.
Skills	Procurement employees have no digital skills or competencies.	Procurement employees have only very limited digital skills and competencies.	Procurement employees have basic digital skills and competencies (e.g., basic IT tool skills).	Procurement employees have advanced digital skills and competencies (e.g., IT know-how, data analytics skills).	Procurement employees have excellent digital skills and competencies (e.g., profound IT know-how, data analytics skills).
IT systems & security	The company has inadequate IT systems and security in place (e.g., disintegrated, outdated legacy	The company has only very basic IT systems and security in place (e.g., heterogeneous IT landscape).	The company has basic IT systems and security in place (e.g., centralized databases, basic firewalls).	The company has advanced IT systems and security in place (e.g., integrated IT architecture, strong firewalls).	The company has excellent IT systems and security in place (e.g., agile, cloud-based IT architecture, fast

Dimension	Digital outsider (Stage 1)	Digital newcomer (Stage 2)	Developing learner (Stage 3)	Seasoned expert (Stage 4)	Digital champion (Stage 5)
	systems, serious IT security gaps).				response to cyber-security incidents).
Digital tools & processes	No digital tools or processes are in place.	Basic digital tools and processes are selectively being implemented (e.g., digital contract database).	Basic digital tools and processes are implemented throughout the company (e.g., supplier portal, WebEDI).	Advanced digital tools and processes are selectively being implemented (e.g., integrated e-procurement suite).	State-of-the-art digital tools and processes are implemented throughout the company (e.g., robotic process automation for P2P).
Category strategy	No category strategies exist for digital products and services. Procurement is not actively searching for digital innovations.	Basic category strategies exist for selected digital products and services. Procurement searches for digital innovations (e.g., touchpads) in a few areas.	Basic category strategies exist for a wide range of digital products and services. Procurement actively searches for digital innovations (e.g., sensors for preventive maintenance) in selected areas.	Advanced category strategies exist for selected digital products and services. Procurement actively searches for digital innovations (e.g., 3D-printing, blockchain) in several areas	Advanced category strategies exist for a wide range of digital products and services. Procurement actively searches for digital innovations (e.g., 3D-printing, blockchain, artificial intelligence) in many areas.
Advanced analytics	No advanced analytics tools are in place.	Implementation of selected advanced analytics tools (e.g., spend cleansing) is being evaluated.	Selected advanced analytics tools (e.g., spend cleansing) are being implemented.	Several advanced analytics tools (e.g., predictive analytics for purchase prices) have been implemented.	State-of-the-art advanced analytics tools (e.g., predictive analytics for purchase prices) have been implemented throughout the company.

CREATION OF COMPETITIVE ADVANTAGE THROUGH SUPPLY MANAGEMENT CAPABILITIES: A RESOURCE ORCHESTRATION PERSPECTIVE

Daniel Krause
Colorado State University
Department of Management - College of Business
217 Rockwell Hall
Fort Collins, CO 80523-1275 USA
daniel.krause@colostate.edu

Davide Luzzini
EADA Business School
Carrer d'Aragó, 204, 08011
Barcelona, Spain
dluzzini@eada.edu

Summary: This study tackles the debate regarding how suppliers can become a resource that helps buying firms achieve competitive advantage. Extant literature is still dissonant in using terms such as resources, capabilities and practices. We use resource-based theory (RBT) and resource orchestration theory (ROT) to investigate how companies utilize their supply management capabilities to manage relationships with their key suppliers, as external resources, to compete on two strategic paradigms: cost and differentiation. We elaborate and test hypotheses through survey data collected in the USA after the downturn, which reshuffled the priorities of many previously existing buyer-supplier dyads.

Keywords: Resource Orchestration; Supplier Management; Survey; Structural Equation Modeling

Category: Competitive Paper

CREATION OF COMPETITIVE ADVANTAGE THROUGH SUPPLY MANAGEMENT CAPABILITIES: A RESOURCE ORCHESTRATION PERSPECTIVE

Introduction

If we accept that our current time is an "age of secular stagnation," we should acknowledge that global GDP may remain close to zero for quite some time (Summers, 2016; Eggertsson, Mehrotra & Summers, 2016). This situation poses interesting questions to management scholars regarding the capabilities that determine firms' success in the absence of significant growth. If the unusually deep recession initiated by the 2008 economic downturn will not be followed – as it seems – by an unusually rapid recovery, what should companies do? This is a multidisciplinary question, but we believe that a major area that should be revisited is the management of business-to-business relationships across the supply chain.

Recent research on companies' most important buyer-supplier relationships (BSRs), or dyads, has shown that the 2008 economic downturn significantly affected many of these relationships. Krause & Ellram (2014) reported that key BSRs, characterized by significant levels of interdependence, differ on various dimensions, including the degree of convergence of the parties' competitive priorities and performance goals. They suggested that the downturn represented a quasi-stress test of these relationships; some emerged from the downturn ready to compete, while others regressed to a relationship characterized by lower levels of cooperation and trust than prior to the downturn. Some dyads came close to dissolution. The authors observed that when cost was a strong focus of a key BSR prior to the downturn, the discussions and activities that took place within the relationship during the downturn were characteristically different than relationships that had previously emphasized performance imperatives other than cost.

The data in the present study was collected several years after many or most firms had recovered significantly from the negative effects of the downturn. These negative effects had included decreased sales, lost or diminished capabilities, reduced capacity through plant closings, and lost market share. Further, there were supply situations where financially vulnerable suppliers had either gone out of business or had laid off many employees and closed some plants, leaving their customers to decide whether to look for new suppliers or to work with these suppliers to rebuild their capabilities and capacity. As a result, many BSRs have been rebooted in order to fit with the new macroeconomic reality that the downturn delineated, and some companies appear to have changed the way they leverage their supplier management capabilities (Krause & Ellram, 2014).

In addition to the observation of a new reality for BSRs, the field needs to bring clarity to the literature applying resource-based theory (RBT) to study BSRs. As indicated by a recent debate in the Journal of Operations Management (Hitt, Xu, & Carnes, 2016; Bromiley & Rau, 2016; Hitt, Carnes, & Xu, 2016), RBT contributes to our understanding of how resources and capabilities are integrated across the supply chain for competitive advantage. However we believe that extant studies have not yet provided clarity regarding how competitive advantage is generated. Since RBT can be complemented with other theories for investigating how firms achieve competitive advantage (Hitt et al., 2016a), we incorporate resource orchestration theory (ROT) based on Sirmon, Hitt, & Ireland (2007), which seems particularly well suited to interpret the BSR phenomenon, and offers an opportunity for theory advancement. Since only a handful of studies have adopted ROT (e.g., Liu et al. 2016; Koufteros, Verghese, & Lucianetti, 2014) we believe it is an important emergent theoretical stream that needs further refinement, especially a clear contextualization into supply chain management.

Resource-based theory and management of key BSRs

The primary research questions in this paper are as follows: *Do companies utilize their BSR management capabilities to manage a BSR focused on cost differently than they manage a BSR focused on differentiation? If so, how?* To approach these questions we adopt the resource-based theory (RBT) of the firm (Wernerfelt, 1984). RBT proposes that companies are able to develop, and perhaps even sustain, a competitive advantage via management of resources that are valuable, rare, inimitable, and non-substitutable.

A resource is defined as those tangible and intangible assets that are semi-permanently tied to the firm (Wernerfelt, 1984), including physical, human, and organizational capital (Barney, 1991). Firms need resources that are valuable and rare to gain competitive advantage, but these resources must also be difficult to imitate and difficult to substitute (Hitt et al., 2016a, p. 78). Intangible resources may be more difficult to imitate because of ambiguity associated with their formation (Hitt et al., 2001). However, Barney (1991) cautions that not all of a company's resources are strategically relevant, and that some companies are better than others at managing their resources for competitive advantage. Thus, recent scholarly efforts within the RBT literature have introduced the sub-theory of resource orchestration (ROT) (Sirmon et al., 2007; Sirmon et al., 2011), which focuses on *how* firms manage their resources.

Sirmon et al. (2011) use ROT to explain how managers transform a collection of resources into capabilities. As noted by Hitt et al. (2016a), this notion of resource orchestration overlaps with the notion of asset orchestration typical of the dynamic capabilities perspective. Dynamic capabilities are considered complementary to RBT; they help explain how resources are developed into capabilities, over time, and in response to changing competitive environments (Teece, Pisano & Shuen, 1997). Barney (2012) notes that purchasing management can be a capability, and when developed within the firm (i.e., not purchased in strategic factor markets) can yield competitive advantage. He also notes that purchasing managers focus on acquiring resources from outside the firm's boundaries, that is, from suppliers. Similarly, Quintens, Pauwels, & Matthyssens (2006, p. 882) define purchasing-related capabilities as "combinations of purchasing routines that are organizational processes by which available resources are combined, transformed and deployed to create valuable purchase-related outcomes."

Unfortunately, the operations and supply chain literatures display some dissonance regarding the distinction between resources and capabilities (Hitt et al., 2016a), which raises the need for clarity in the use of these terms. Our review of the literature about BSR management reveals several sources of dissonance including: (i) different terms that – within the same study – are used interchangeably; (ii) different terms that – across studies – indicate the same concept (e.g., resources and capabilities, skills and capabilities, practices and capabilities); and (iii) same terms that – across studies – indicate different concepts (e.g., capabilities). This dissonance appears to not be limited to the supply chain literature (Wang & Ahmed, 2007).

Referencing the definitions provided above and applying them to purchasing and purchasing managers, we view purchasing managers' knowledge and skills as internal resources of the firm. Suppliers are resources that are external to the firm, that have their own internal resources and capabilities. Purchasing's capabilities are developed through the integration of managers' knowledge and other employees' skillsets to manage BSRs with the strategic goal of aligning supplier-resources and capabilities with those of the firm.

For the present study, we propose that purchasing managers can build BSR management capabilities within the firm that may be relatively unique to the firm and be, from an external observer, causally ambiguous. We argue that as a company accumulates human capital, specifically in the form of purchasing managers and related personnel, over

time it can manage these resources for competitive advantage. Thus, a firm may build purchasing capabilities focused on management of BSRs, which in turn are able to access suppliers as external bundles of resources and capabilities. The firm's internal purchasing capabilities may become, over time, valuable, rare, inimitable and non-substitutable (VRIN) (Barney, 1991). These internal capabilities may be applied to manage key BSRs in unique ways, yielding further capabilities within the BSR that become VRIN. Due to space constraints, we are not further expanding on this argument, which finds support in the purchasing literature.

Resource orchestration theory: transforming purchasing resources into BSR management capabilities

Once we acknowledge that BSRs can be VRIN and are worth the time and effort to develop, the next question becomes: how can firms build BSRs that will become VRIN and therefore generate a competitive advantage in terms of either cost or differentiation? This question might be answered by considering the managerial routines that purchasing managers put in place to integrate external resources residing within suppliers with resources internal to the firm. Despite extant studies offering some suggestions regarding complementary theories that would serve this purpose (including transaction cost theory, dynamic capabilities, knowledge based view, and agency theory – Hitt et al., 2016a, p. 81) we did not find a sufficiently comprehensive explanation that is rooted in the core principles of supply chain management. Therefore we advance resource orchestration as a possible solution to this gap.

ROT is focused on managers' efforts to effectively manage resources. Sirmon et al. (2007, p. 273) define resource management as "the comprehensive process of structuring the firm's resource portfolio, bundling the resources to build capabilities, and leveraging those capabilities with the purpose of creating and maintaining value for customers." The authors further propose that *structuring* resources involves "acquiring, accumulating and divesting" resources to bundle and leverage them. *Bundling* is the dynamic process of "stabilizing, enriching, and pioneering" resources to build capabilities (Hitt et al., 2016a). *Leveraging* is "mobilizing, coordinating and deploying" capabilities with an external focus on accessing market opportunities.

Structuring the Supply Base via Acquiring, Accumulating, and Divesting

We propose that the unit of analysis changes as the firm seeks to manage its supply base through the structuring, bundling and leveraging processes, as shown in Figure 1. A supply base is defined as constituting "only those suppliers that are actively [and directly] managed through contracts and the purchase of parts, materials and services" (Choi & Krause, 2006, p. 639). During structuring, the focal firm analyzes its supply base in relation to the supply network, which includes "all inter-connected companies that exist upstream to any one company in [a] value system," (p. 638) regardless of whether the focal company is knowledgeable of their existence. In structuring, the focal firm seeks to raise the caliber of its supply base through establishing contractual relationships with new suppliers (*acquiring*), and seeking to bolster its store of external resources and capabilities that reside within its

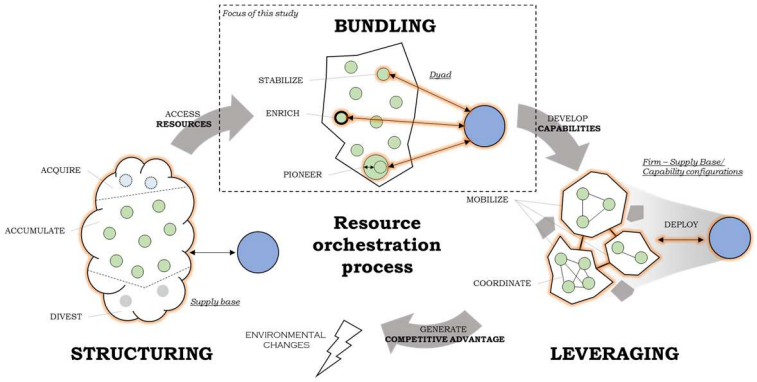

Figure 1 – Resource Orchestration Process

suppliers by *accumulating* and *divesting*, that is, adding additional suppliers where needed and eliminating those suppliers that are not performing well or are not needed from a resource-based perspective (Treleven & Schweikhart, 1988). The unit of analysis in this effort is the supply base. This process is known in the supply chain literature as supply base optimization or supply base rationalization (Choi & Krause, 2006), and may be a continual, ongoing effort. Goals of this process include minimization of risk, lower transaction costs, and ultimately maximizing value for the focal firm's customers.

Bundling Key Dyads via Stabilizing, Enriching, and Pioneering

Although supply base rationalization may be an ongoing process, especially in the context of significant environmental uncertainty, the effort to orchestrate resources also includes a focus on the focal firm's most important BSRs. Sirmon et al. (2007) note that bundling "is the process by which capabilities are formed" (p. 281). Here, the unit of analysis shifts to focus on each of the many key dyads managed by the focal firm, that is, on a specific supplier relationship, its performance and capabilities. Specifically, the unit of analysis for bundling is the dyad. From a purchasing perspective, *stabilizing* may be a remedial process, and thus focused on a particular supplier's perceived weaknesses. Stabilizing capabilities may include rearranging or reallocating resources, and this may take place across organizational boundaries as the companies within the dyad seek to build capabilities, uniquely combining their resources (Sirmon et al., 2007). The expectations are, at minimum, for incremental improvements in one or two areas of a supplier's performance. Next, *enriching* may involve strengthening a supplier's capabilities that are related to already existing capabilities. The effort here is focused on building or extending capabilities. Finally, *pioneering* involves efforts to build new capabilities (Sirmon et al., 2007). These efforts may be the result of attempts to innovate new products, or to further differentiate existing products.

Leveraging the Joint Capabilities of the Firm and its Supply Base via Mobilizing, Coordinating and Deploying

We propose that the unit of analysis again shifts to now include the entities of the focal firm *and* the suppliers in the firm's supply base. The leveraging process involves the focal firm now using its enhanced supply base, including and its key BSRs to mobilize, coordinate and deploy these newly enhanced resources and capabilities (Sirmon et al., 2007). *Mobilizing* refers to the buyer picking the right supplier for the right task within the pool that has been created during the bundling phase. Rather than independently selecting each single supplier, the buying firm must consider the complex set of possible interactions between suppliers and *coordinate* them for the creation of capability configurations that are consistent with the firm's strategy. This task may become increasingly difficult as the complexity of the supply base and the pattern of interactions increase (Choi & Krause, 2006; Wu, Choi, & Rungtusanatham, 2010). Finally, *deploying* refers to the activation of the required sets of supplier capability configurations at the right time, for example in a given moment of the new product development process (to ensure the efficient and effective integration of supplied components ahead of the engineering phase), or during the normal production planning cycle (to ultimately ensure the final customer service level).

Hypotheses

In the present study, our primary focus is on the firm's use of its existing supply management resources and capabilities to align key supplier resources with its competitive strategy. After the economic downturn that started in fall 2008, companies began to emphasize cost as a supplier performance criterion to a greater extent than prior to the downturn (Krause & Ellram, 2014). From an RBT/ROT perspective, we propose that the supply base has largely been structured, through a continual process of selecting and accumulating suppliers, and divesting

of suppliers that either do not align with the firm's competitive strategy or do not exhibit a willingness or ability to align. In the present study, we focus on bundling the firm's internal resources and capabilities with the external resources and capabilities represented in the supplier. Therefore, our unit of analysis for this study is key buyer-supplier dyads.

In bundling the BSR, the firm may seek to *stabilize* a supplier's capabilities, *enrich* or enhance the supplier's capabilities where needed, and to *pioneer* or develop new capabilities with the supplier. If successful, these bundling activities will produce a BSR that combines and aligns the internal resources and capabilities of the buying firm with those of the supplier's. Ultimately this relationship will be leveraged to enable the two companies to reach their competitive goals through leveraging, via mobilizing, coordinating and deploying, these resources and capabilities in the marketplace.

BSR Management Capabilities vis-à-vis Differentiation and Cost Leadership Strategies

Following Sirmon et al. (2011), the present research focuses on cost leadership and differentiation as two fundamental business strategies companies use to gain competitive advantage. Firms competing through differentiation attempt to differentiate their products and/or services from those of their competitors. Sirmon et al. (2011) note that "the capabilities through which the firm provides superior value must be dynamic in that they have to be constantly updated in order to remain ahead of competitors. As such, dynamic managerial capabilities are needed" (p. 1398) in environments that are characterized by significant levels of competitive rivalry and its resulting levels of environmental and technological uncertainty and change.

In contrast, a cost leadership strategy "requires investments in specific resources to build capabilities that produce efficiency while simultaneously minimizing investments in other resources that do not help them meet efficiency goals" (p. 1398). Therefore, we propose the following *overarching or foundational* propositions as an underlying assumptive framework for our hypotheses. We provide specific hypotheses further below.

> ***Proposition 1a****: Companies whose purchasing personnel focus their resources and capabilities on aligning a cost-focused BSR, will engage in a different collection of supplier management, or resource orchestration activities than those companies working to align a differentiation-focused BSR.*
>
> ***Proposition 1b****: Respondents that claim to be competing on a differentiation strategy will report greater levels of technological uncertainty than respondents competing on the basis of cost leadership.*

Overall, it is the buying firm's human capital resources, in the form of purchasing managers, that decide what combination of capabilities and resources should be used to maximize the value the firm attempts to derive from any particular BSR.

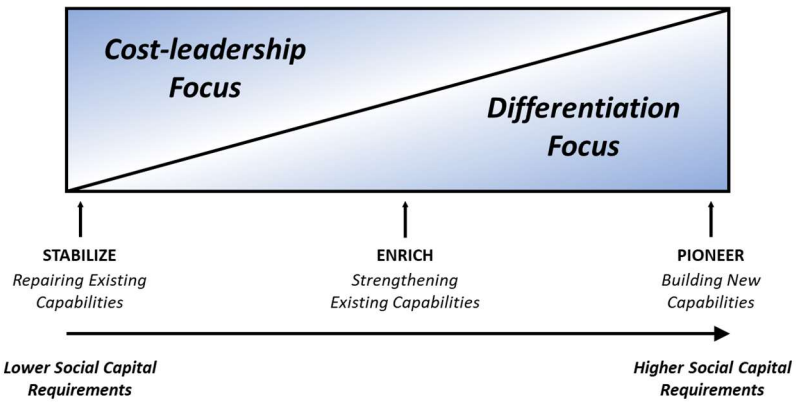

Figure 2 – Bundling stage of BSR management

Six independent constructs were used in this study to represent a range of activities that supply managers may use to influence the performance of key suppliers and ultimately result in capabilities that may be characterized as VRIN. The first three variables are *supplier competition*, *black box monitoring*, and *operational communication*. Overall,

these constructs represent relatively low levels of resource expenditure by the buying firm and relatively little social capital investment by purchasing managers. As such, they are more likely to be utilized by cost leaders who are focused on efficiency, while minimizing investments in alternative, more resource-intensive, supply management resources that do not help meet efficiency goals (Sirmon & Hitt, 2009), as shown in Figure 2.

The last three constructs are *close monitoring*, *know-how exchange*, and *supplier collaboration*. Each of these constructs involves significantly higher levels of resource commitment, including social capital building, than the three discussed above. Dynamic managerial capabilities are comprised of managerial cognition, managerial social capital, and managerial human capital (Helfat & Martin, 2015). Choosing to engage in close monitoring of suppliers, know-how exchange with suppliers, and supplier collaboration requires that managers understand the implications of their choices (managerial cognition), are willing to expend resources in developing goodwill with suppliers (managerial social capital), and have knowledge regarding how to combine a supplier's resources and capabilities with those of their own firm's (managerial human capital) (Helfat & Martin, 2015, pp. 1285-1286). These underpinnings of dynamic managerial capabilities are especially important for managers who work in highly competitive, quickly changing environments that experience rapid technological change (Teece, 2007).

Although these six independent constructs may be used by firms that are competing as cost leaders as well as those competing on a differentiation strategy, we propose that *supplier competition*, *black-box monitoring* and *operational communication* are more likely to be emphasized by cost leaders, in that they represent relatively low levels of resource commitment, and are more likely to be used to stabilize a supplier's weaknesses and result in incremental improvements in the capabilities that become embedded in the BSR.

BSR Management Resources and Capabilities for Low Levels of Resource Commitment

The following three independent constructs in this study, supplier competition, black box monitoring and operational communication represent relatively low levels of resource commitment to the BSR and relatively low levels of managerial cognition, managerial social capital, and managerial human capital. The scale items used to measure each construct are shown in Table 3.

1. ***Supplier competition***: Competition in a supply management context involves the use of more than one supplier for the purchase of a particular item or service. Purchasing an item from multiple suppliers decreases the buying firm's dependence on any one supplier. Putting an item out for bid to alternate suppliers may keep suppliers price-competitive. Essentially, the firm is deliberately using market factors to achieve this goal, minimizing the use of its internal resources and capabilities. Clearly, any firm may use competition to incentivize supplier performance, but we expect that firms focused on competing as a cost leader would use competition to a greater extent than firms focused on a differentiation strategy. The two scale items used to measure this construct have been used in previous studies (Krause, 1999; Krause, Handfield, & Tyler, 2007).

2. ***Black-box monitoring***: Similar to competition, black-box monitoring represents a relatively low level of resource use, where the supplier is assumed to be able to perform with relatively little supervision or intervention by the buying firm. Evaluation systems are put in place, but only the product shipped by the supplier is evaluated, for example, evaluation of incoming quality at the buying firm. The focus is on the product, not the supplier's processes that make the product. Three scale items, adapted from Oliver & Anderson (1994), were used to measure this construct. Black box monitoring suggests that the buyer assumes, perhaps based on experience, that the supplier has the capabilities to perform.

3. ***Operational communication****:* Here, the buyer makes an effort to provide the supplier with long-range forecasts, production plans, and design changes. These informational inputs could be shared via communication systems, but also person to person. These survey items (Noordewier et al., 1990) suggest that the buyer is communicating its plans so as to allow the supplier to schedule efficiently.

These three approaches make use of market forces and represent low-cost, efficient efforts to manage BSRs. They also require low levels of social capital, thus consuming fewer resources. Overall, we expect cost-oriented buying firms will prefer the adoption of these three relatively low-cost BSR management resources, relative to firms oriented towards differentiation:

> ***Hypotheses 1a, b, c****: Less affected by high levels of technological uncertainty, companies whose purchasing personnel focus their resources and capabilities to align a cost-focused BSR will engage in a) supplier competition, b) black-box monitoring, and c) operational communication to a greater extent than a BSR focused on differentiation.*

BSR Management Capabilities for High Levels of Resource Commitment

We propose that close monitoring of a supplier, know-how exchange with a key supplier, and supplier collaboration are more likely to be emphasized by firms pursuing a differentiation strategy, in that they represent relatively high levels of resource investments and require greater investments in BSR management capabilities. As such, they are more likely to be used to enrich existing capabilities, and/or pioneer new capabilities, that become uniquely embedded in a key BSR. These activities also require greater levels of managerial cognition, social capital and human capital (Helfat & Martin, 2015) and may be required for firms competing in markets with relatively high levels of technological change. As above, all scale items used to measure these constructs are shown in Table 3.

4. ***Close monitoring***: Here, the buying firm has moved well beyond the black box approach, and is concerned that the supplier knows *how* to do its work. The focus is on the supplier's processes. The scale items for this construct (Oliver & Anderson, 1994; Verbeke, Ouwerkerk, & Peelen, 1996) suggest a more proactive approach by the buyer, keeping in close contact and staying well informed of the supplier's activities. Empirical evidence suggests that better results can be obtained when the supplier is involved in the design of a monitoring system and when such system is used to mutually develop the buyer-supplier relationship rather than as a punishment tool (Luzzini, Caniato, & Spina, 2014).

5. ***Know-how exchange****:* The scale items for this construct are adapted from Doney & Cannon (1997) and indicate a willingness to share confidential information in order to help the supplier perform. The sharing of confidential information represents a relationship-specific investment and implies at least minimal levels of social capital, as shown in Figure 2, and trust within the relationship.

6. ***Supplier collaboration****:* These items based on Krause et al. (2007) manifest a significant effort by the buying firm to use its personnel to help the supplier improve. Regular visits and a supplier development team manifest a significant allocation of resources to work with the supplier face-to-face to effectively manage the capabilities that the supplier represents. As shown in Figure 2, these efforts involve greater levels of social capital and may be focused on building new capabilities within the BSR.

Building on these premises we can introduce our third set of hypotheses:

> ***Hypotheses 2a, b, c****: Affected by relatively higher levels of technological uncertainty, companies whose purchasing personnel focus their resources and capabilities to align a differentiation-focused BSR will engage in a) close monitoring, b) know-how exchange, and c) supplier collaboration to a greater extent than a BSR focused on cost leadership.*

Method

To test our hypotheses we administered a mail survey to Supply Chain professionals in the USA using contact information provided by the Institute of Supply Management (ISM). The data were primarily collected in 2015, i.e., after the downturn had shown its effects. The survey questionnaire contained specific questions about purchasing priorities, capabilities and results obtained using scales derived from the literature. Before distribution, the questionnaire was pre-tested by several supply chain executives and academics to check the clarity of the questions. Before and during the pre-testing phase, special emphasis was placed on the quality of the question formulation in order to reduce potential bias resulting from respondents' misleading cognition (Poggie, 1972; Schwarz & Oyserman, 2001). In particular we concentrated our questions on observable data and excluded possible scope of interpretation.

The survey targeted supply chain professionals and the instructions asked respondents to "please focus your answers on *one* supplier that provides your firm with a *critical* item (material, component, or service). The supplier should also be one that your firm has made an effort to improve. This improvement effort could be relatively limited and include activities such as supplier evaluation, or be more extensive and include such activities as training of the supplier's personnel. We are interested in your responses regardless of the extent of the effort." Thus, this primary section of the survey focused on our unit of analysis: a key BSR dyad.

ISM provided a random sample of 2,538 of its members' mailing addresses, limiting the names to members working in manufacturing industries. One of the authors was in charge of the data collection process in the USA, which focused primarily on postal mailings. Following similar key-informant-based research studies, the goal was to find the right person within the organisation who was able to respond to questions about their firm's purchasing strategy, a key buyer–supplier relationship, and performance. For this reason, mostly senior supply managers were targeted. In the end, 1,349 names were randomly chosen from the original set of names provided by ISM for the first mailing. A subset was chosen because of budgetary constraints, and because the goal was to achieve as high a response rate as possible from a smaller number of prospective respondents. Reminder postcards and additional surveys were mailed to non-respondents. To further increase the response rate, we attempted to identify phone numbers for all non-respondents by searching LinkedIn.com and Google.com. When successful in this search attempt, a graduate student phoned the non-respondents, asking for their participation. In these cases, the surveys were typically emailed to respondents who had agreed, via phone, to participate. Some surveys were returned via email attachment, others via fax, while the majority were returned via postal service. A small number of returned surveys were incomplete, and they were deleted from consideration for analysis. Approximately 60 surveys were returned because the respondent was no longer at the address provided by ISM or the company had a policy of not providing survey responses. After digitalizing and cleaning the data, 203 usable surveys were retained, representing a response rate of approximately 15.7 percent.

Non-respondent bias was examined by using the oft-used approach of testing for differences in terms of size and sector distributions between respondents and non-respondents (Armstrong & Overton, 1997). No differences were found. In addition, given that we relied on a single respondent design (with the exception of collecting a very small number of surveys from suppliers for validation), we controlled for common method bias in two ways: through the design of the study and through statistical control (Podsakoff et al., 2003). Regarding the survey, the research project was labelled as a broad overview of purchasing and supply chain management: no explicit reference to the intention to test antecedents of cost and differentiation outcomes was evident. Thus, the respondents' attention was not drawn to the relationships being targeted in this study. Questions including items and constructs related

to each other in the general model were also separated in the questionnaire in order to prevent respondents from developing their own theories about BSR management capabilities and possible cause–effect relationships. Further, the questionnaire was carefully pre-tested and respondents were assured of strict confidentiality. Finally, we used different scales and formats for the independent and criterion measures (Podsakoff et al., 2003). As a second means to ensure against common method bias, we examined the unrotated factor solution for the constructs included in our model (Podsakoff & Organ, 1986), checking that neither a single nor a general factor was likely to account for the majority of the covariance among the measures.

We asked the buyer respondents if they would be willing to share information on a contact at the "key supplier" they had reported on in the buyer survey. We assured confidentiality in this effort; however, only 31 buyers provided supplier contact names. Subsequently, we distributed a symmetric questionnaire to those 31 suppliers to check their responses against buying firm's answers. Unfortunately, only seven supplier surveys were received. While this result represents a twenty-two percent response rate, the absolute number of surveys is too small to perform any valid analysis.

Description of Sample

The survey respondents were upper level purchasing managers and executives with an average of 12.4 years with their respective companies. Titles of the respondents included Directors, Purchasing/Supply Managers, Senior Buyers, Category/Commodity Managers, and other similar miscellaneous titles. These titles, combined with the respondents' average years of experience with their respective companies, suggest that these respondents were highly qualified key respondents, and as such were capable of answering the survey questions. Respondents were employed in a variety of manufacturing industries, including aerospace, electronic equipment, construction equipment, testing equipment, industrial tools and medical devices. These respondents worked primarily for medium to large companies, in terms of gross annual sales dollars. These companies had an average of 16,400 employees (median: 1,700). The respondents estimated their firm's percentage of total purchase dollars to total sales dollars on average to be 42 percent (median: 40 percent).

Results

Hypotheses were tested using structural equation modelling (SEM) with the maximum likelihood (ML) estimation method. Most SEM applications described in the literature are analyzed with this methodology. The hypothesized model was tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it was consistent with the data. Where goodness-of-fit is adequate, the model can be seen as a plausible explanation of postulated interactions between constructs. The research model is analyzed and interpreted sequentially: first the assessment of the reliability and validity of the measurement model, and secondly the assessment of the structural model (Hulland, Chow, & Lam, 1996). The R software (https://cran.r-project.org) was used to estimate both the measurement model and the structural model. The ML algorithm was used to obtain the paths, the loadings, the weights, and the quality criteria.

Measurement model

Since we aimed to test supply management capabilities that ultimately affect the supplier's contribution to cost reduction and differentiation we designed two sets of single-item scales aimed at measuring these two concepts as latent variables. Respondents rated each item on a Likert scale where 1 = strongly agree, 4 = neutral and 7 = strongly disagree. We based our

measures on existing scales (Krause et al., 2007) and subsequently conducted an exploratory factor analysis (EFA) with Varimax rotation for validation.

In order to include the most important concepts in terms of BSR management capabilities we conducted a thorough review of the literature and leveraged on the authors' experience of supply management within firms as well. As a result we designed a list of items measuring BSR management capabilities and subsequently conducted an EFA, dropping a small number of items with cross-loadings and low loadings.

Finally, in addition to the dependent variables and independent variables measuring BSR management capabilities we included in the model a latent variable measuring technological uncertainty as part of our hypotheses. The scale items were adapted from Ross et al. (1997), Jap (1999 and 2001), Scannell (2002), McEvily & Marcus (2005), Krause et al. (2007).

The resulting measurement model consists of nine multi-item constructs with a total of 25 indicators. We used several tests to determine the convergent and discriminant validity of the six reflective constructs. As anticipated, we controlled through an EFA that all item loadings between an indicator and its posited underlying latent variable was acceptable with no relevant cross-loadings. Next, Table 3 shows the measurement scales of the reflective constructs investigated by our research model through confirmatory factor analysis (CFA). We verified the measures by assessing reliability and unidimensionality of each of the nine constructs, i.e. item-to-total correlations within each construct were examined (Churchill, 1979). Our measurement model is able to provide to a great extent discriminant validity as well as convergent validity (Bagozzi & Yi, 1988; Anderson & Gerbing, 1988; Fornell & Larcker, 1981): both composite reliability (CR) and average variance extracted (AVE) were above the recommended threshold of 0.7 and 0.5, respectively (Fornell & Larcker, 1981; Nunnally and Burstein, 1994). Only the *close monitoring* and *know-how exchange* show AVE slightly below the threshold. To further test for discriminant validity, we compared the squared correlation between two latent constructs and their AVE estimates (Fornell & Larcker, 1981). These constructs meet the validity condition of the AVE estimates exceeding the squared correlation between each pair of constructs.

Finally, we evaluated the overall model fit in two ways (Hu & Bentler, 1998): with the chi-square goodness-of-fit statistic and with other absolute or relative fit indices. It is quite common in management literature to avoid using the chi-square p-value as this measure is particularly sensitive to sample size and assumptions of normality (Hu & Bentler, 1998). As a consequence, other fit indices are preferred to the p-value. Some authors suggest checking for the ratio between chi-square value and degrees of freedom in the model, where cut-off values range from <2.0 to <5.0 depending on the investigator (e.g., Kelloway, 1998). Another way to evaluate the fit of a model is to use fit indices that have been offered to supplement the chi-square. Fit indices range from 0 to 1, with values closer to 1 indicating good fit. Hu & Bentler (1999) recommend MLE-based fit indices and also suggest a two-index presentation strategy with, among others, the comparative fit index (CFI), and Gamma hat or root mean square error of approximation (RMSEA). The CFA revealed a sufficient model fit attested through such fit indices for the measurement model (Shah & Goldstein, 2006): χ^2=326.4; χ^2/d.f.=1.38; RMSEA=.045; CFI=.954.

TABLE 3 – Confirmatory factor analysis of latent variables

First-order construct	Indicator	Loading	CR	AVE
Technological uncertainty	Our industry is characterized by rapidly changing technology	0.903	0.780	0.613
	If we don't keep up with changes in technology, it will be difficult for us to remain competitive	0.865		
	The rate of product obsolescence is slow *(reverse coded)*	0.470		
Supplier competition	Use of multiple suppliers for this purchased item to create competition among suppliers	0.764	0.759	0.613
	Occasionally put the item we buy from this supplier, out for bid to keep this supplier competitive	0.801		
Black-box monitoring	This supplier is only judged based on its performance in areas that matter to us	0.609	0.754	0.561
	With this supplier, only tangible results matter to us	0.937		
	We don't care what this supplier does, as long as they produce	0.642		
Operational communication	We keep this supplier informed of our production plans	0.926	0.817	0.672
	We provide this supplier with long-range forecasts of supply requirements	0.741		
	We inform this supplier well in advance of impending design changes	0.831		
Close monitoring	We make sure this supplier knows what to do and how to do it	0.573	0.684	0.428
	We stay in close contact with this supplier	0.822		
	We stay well informed of this supplier's activities	0.611		
Know-how exchange	Any information that might help this supplier will be provided to them	0.788	0.792	0.413
	Exchange of information in this relationship takes place frequently	0.794		
	It is expected that the parties will provide proprietary information if it can help the other party	0.612		
	This supplier will share confidential information to help us	0.538		
Supplier collaboration	Allocation of your personnel to improve supplier's technical skill base	0.779	0.779	0.544
	Regular visits by your engineering personnel to supplier's facilities	0.724		
	Dedicated supplier development team	0.712		
Cost	This supplier has helped lower the total cost of our products	0.842	0.804	0.677
	This supplier has helped reduce our product cost	0.801		
Differentiation	This supplier has helped differentiate our products from those of our competitors	0.951	0.947	0.900
	This supplier has helped make our products more unique	0.947		

Fit indexes: *chi-square=326.4; p-value=0.000; chi/d.f.=1.38; CFI=.954; RMSEA=.045*

Structural model

The postulated path model produced a sufficient fit to the data (χ^2 = 1020.6; χ^2/d.f. = 1.64; RMSEA = .053; CFI =.943). Figure 3 shows the results of the hypotheses testing.

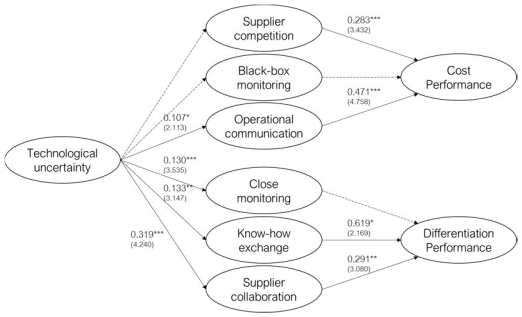

Figure 3 – SEM results

Most of our hypotheses were confirmed. We found clear evidence that companies competing as differentiators engage in a different set of resources orchestration activities to manage key BSRs than cost-focused companies. This result provides support for our overarching proposition, P1a. Further, Technological Uncertainty was significant to a greater extent for Differentiators than Low-Cost competitors, providing support for P1b.

Two of the three constructs that we expected to relate to cost reduction performance (i.e., *supplier competition (H1a)* and *operational communication (H1c)*) were significant, while *black-box monitoring (H1b)* was not. At the same time, these factors were not significantly linked to differentiation performance. Similarly, two of the relatively more resource intensive and social capital intensive constructs (i.e., *know-how exchange (H2b)* and *supplier collaboration (H2c)*) were significantly related to differentiation performance but not to cost performance.

Overall, we found that technological uncertainty significantly affects the adoption of relational-intensive capabilities that are typical of differentiators whereas less relational-intensive capabilities are not affected, with the exception of operational communication.

Discussion

The focus of this study was to investigate how buying firms can work with their suppliers, as external resources, to develop their capabilities with a goal of improving the buying firm's ability to compete on the basis of cost or differentiation through capabilities built across key buyer-supplier dyads. Our unit of analysis is key buyer-supplier dyads, or BSRs. We proposed that BSRs can be VRIN resources for the buying firm, perhaps ultimately contributing towards achieving a competitive advantage. We think the results of the analysis support this conclusion, and support our theoretical model in Figure 2.

We used RBT and ROT to explicate and test how purchasing and supply managers can manage their supply bases through structuring, bundling and leveraging activities. *Structuring* is focused on the supply base, that is those suppliers that are actively [and directly] managed through contracts and the purchase of parts, materials and services" (Choi and Krause, 2006, p. 639), and involves establishing relationships with new suppliers, and divesting of suppliers that are not needed from a resource-based perspective, a process often referred to as supply base rationalization. *Bundling* is focused on specific BSR dyads, through stabilizing, enriching and pioneering processes, where the emphasis is on strengthening existing suppliers' capabilities and building new ones where needed. Bundling may also result in synergistically building capabilities across the buyer-supplier interface, such that neither party is capable of building these capabilities alone. *Leveraging* is focused on the buying firm *and* its supply base,

collectively, a combination of the internal resources and capabilities of the buying firm and the resources and capabilities of key suppliers.

The primary focus of our hypotheses and analysis was on the *bundling* stage, as depicted in Figure 2. We proposed that companies competing as differentiators, and as such dealing with technological uncertainty to a greater extent than low-cost producers, would focus their activities more toward strengthening existing capabilities and building new capabilities within key BSRs. Low-cost competitors, in contrast, are focused on efficiency, and will refrain from spending resources unless absolutely necessary. As such, they are primarily concerned with repairing suppliers' existing capabilities, as opposed to building new ones, and doing so as efficiently as possible. These efforts tend to minimize the time and resource consuming processes of building and maintaining BSRs.

Our findings suggest that low-cost competitors do manage their key BSRs differently than companies that compete as differentiators. Differentiators engaged in activities that required higher social capital investments, focusing to a significantly greater extent than low-cost competitors on *know-how exchange* with key suppliers and *supplier collaboration*. Low-cost competitors engaged in activities with lower social capital requirements, focusing on *supplier competition* and *operational communication*.

Only the two monitoring constructs (i.e. *black-box* and *close monitoring*) did not significantly affect cost and differentiation performance respectively. We can interpret this result as an indication that monitoring systems per se are not sufficient to ensure the creation of a competitive advantage. Considering the BSR capabilities with lower social capital requirements, black-box monitoring was not significant compared to putting competitive pressure on suppliers and sharing operational information. Similarly, between the more resource-intensive BSR capabilities, collaborating with suppliers and sharing sensitive information were more effective than close monitoring. On the one hand, we might conclude that supplier evaluation systems are now widely adopted, up to the point of becoming necessary but are insufficient for significantly improving a supplier's capabilities. On the other hand, we think that the complex dynamics characterizing the agency problem would require inclusion of other classical agency theory constructs that are outside the scope of this study (such as incentives, goal congruence, and supplier opportunism).

Our study also illustrates the usefulness of resource-based theory and resource orchestration theory to the understanding of supply chain relationships. RBT suggests that suppliers and purchasing departments can be a source of competitive advantage even though some extension is needed to clearly apply RBT in the context of BSRs. Specifically, ROT is a valuable and complementary theory in explaining how competitive advantage is created through structuring, bundling and leveraging stages.

Limitations of our study include the lack of significant numbers of supplier responses that might have further validated our results. Only a few buyer respondents provided contact information for the suppliers on which they had reported. Although more than twenty-percent of the suppliers we contacted did respond to a mirror-version of our buyer survey, the absolute number of returned supplier surveys was insufficient to perform statistical analysis. We think that this result is partly due to the sensitive nature of these key BSRs, and the resulting reluctance to share information about them, and also because of time constraints that prospective respondents often claim when declining to participate in survey research. Additionally, we based our results on a single respondent

survey. Even though this is appropriate considering the scope of our study (i.e. the buyer's management of the supplier relationship), future studies might provide additional validation through objective data and/or multiple respondents. Further, we chose only to investigate the bundling stage of the resource orchestration process. In order to extend the analysis to the other stages (i.e. structuring and leverage) a different research design is needed, with attention paid to the shifting units of analysis we have proposed. For example, a study encompassing all three stages would necessarily require a longitudinal perspective. Moreover, since this is one of the first studies to adopt ROT in the context of BSRs, we were limited to testing the direct relationship between capabilities and performance. Future studies might provide a more nuanced view by exploring boundary conditions and contingent factors starting from our base model. Finally, we already commented the unexpected results related to the monitoring constructs: it might be worth exploring this issue more in depth, allowing a compelling evaluation of the effectiveness of monitoring activities.

However, we recognize that some of our limitations might open an avenue for further research. Firstly, we base our result on a single respondent survey. Even though this is appropriate considering the scope of our study (i.e. the buyer's management of the supplier relationship), future studies might provide additional validation through objective data and/or multiple respondents. Future studies might also provide a more nuanced view by exploring boundary conditions and contingent factors starting from our base model.

Conclusion

In this study we advanced the theory of BSRs management by adopting an RBT perspective in connection with ROT. In particular we contribute to clarifying why – in line with RBT – purchasing and supply management capabilities can be considered VRIN resources and how – in line with ROT – such resources can be transformed into capabilities that are expected to generate a competitive advantage. Resources and capabilities residing within the buying firm can be brought to focus on key supplier relationships, and working with suppliers can build additional capabilities across the BSR. Success through these efforts may bring competitive advantage for buying firms, whether they are competing on the basis of low-cost or differentiation.

We reviewed the foundational principles of ROT (Sirmon et al., 2007, 2011) and demonstrated unique opportunities the BSR domain offers in term of theory development. Despite previous studies essentially applied ROT within the firm boundaries, BSRs and the supply chain at large seem an ideal lab to extend and test the theory as they inherently require the orchestration of an increasingly complex set of resources and capabilities. Out of the three main stages of the resource orchestration process (i.e. structuring, bundling, and leveraging) our focus is on the bundling stage, which is concerned with the development of BSR management capabilities at the dyad level. Through cross-sectional survey data collected in 2015 we show that firms aiming at cost-reduction focus on a fundamentally different set of capabilities as compared to firms oriented towards differentiation. We also show that differentiation-building capabilities are adopted in the presence of higher technological uncertainty, which is consistent with the ROT predictions.

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Orchestration of External Resources

Laiho, Aki
Aalto University, School of Science

Maarintie 8, FI-02150 Espoo
Finland
+358 40 6525827
laiho.aki@gmail.com

Abstract

The paper reports on the findings of a multiple case study, focusing on orchestration of external resources in a manufacturing context. The empirical research focuses on six case companies and their 17 strategic buyer-supplier relationship, with a purpose to empirically identify how orchestration is manifested in their activities, and whether it is context-dependent. The key findings are first, that the concept of orchestration can be identified empirically. Second, based on governance model and relationship focus, four managerial situations are established. Third, a viable orchestration profile for each of the situations is developed. The paper contributes to the discussion of management of interconnected firms and external resources.

Keywords: External resources, orchestration, governance

Introduction

Effective utilization of external resources has become a source of competitiveness of companies and has also received substantial attention at major academic journals (see Tanskanen et al 2017) during the last decades, when purchasing has evolved from transactional function to the current more strategic position (van Weele, 2005, van Weele and Raaij, 2014, Tanskanen et al., 2017). Parallel to the evolution of purchasing, also the concept of orchestration emerged late 1990´s, as companies and academics started to look for strategic alternatives for vertically integrated companies, emphasizing the focus on accessing and leveraging external resources, in contrast of owning and operating the resources. In the following chapter the extant literature around orchestration is reviewed, but as a summary the concept can be initially defined as an *intentional act where a company is creating and capturing value by building, directing and leading networks of external resources*. This definition, however, fails to take into account at least on two critical aspects. First, what practices actually relate to the generic concept of orchestration? Second, do the definition or related practices depend on situation, context, or capabilities of the orchestrator? The earlier contributions identify lists of activities that orchestrators may do or may need to do in general, but specific research findings identifying activities that make orchestration possible and happen, especially in specific situations and in a manufacturing environment, are still scarce. Objective of this paper is to *clarify the concept of orchestration* in context of external resource management, and to identify *how orchestration is manifested in different managerial situations* that the case companies face. The literature review begins with perspectives on governance, in order to ground the managerial situations to a

theoretical background, and continues with review of the extant literature on orchestration itself as well as on integration, coordination and procurement discources, to provide the basis for analysis of the managerial practices. The main emphasis is to report the findings from a serie of case studies from six case companies, identifying the orchestration situations as well as the related managerial practices, respectively. At the end the contribution of the findings is discussed.

Literature background

Governance forms in external resource management

The external resource management (ERM) discourse has been dominated by two theoretical backgrounds, namely transaction cost economics (TCE) and resource-based view (RBV) (van Weele and van Raaij, 2014; Tanskanen et al., 2017). In the TCE the firm is seen as a governance structure, where markets and companies are seen as alternative means for organizing similar kinds of transactions. Some scholars (e.g. Williamson, 2000; 2008) have argued that an economical exchange can be arrayed in a continuum-like fashion with discrete market transactions on one end and the highly centralized and integrated firm at the other. Later this discourse has advanced to recognize a variety of hybrid modes of governance and related practices (Williamson, 2008). However, many scholars have observed that governance of inter-organizational exchanges involve more than formal contracts. The relational view and social network theories have provided important insights (Gulati, 1998; Dyer & Singh, 1998; Lavie, 2006). The main observation is that inter-organizational exchanges are embedded in social relationships (Poppo and Zenger, 2002) and often governed through different types of contracting that can be for instance recurrent or relational (Ring & van der Ven, 2002). Additionally, network forms of governance and their relationship to the markets – hierarchies –continuum have received increasing attention (Jarillo, 1988; Powell, 1990; Choi and Krause, 2006; Gulati et al., 2011). An interesting view to governance is provided by Heide (1994) who analyzes the governance of partnerships and other inter-firm alliances. By analyzing relationship initiation, features related to relationship maintenance and relationship termination, he divides the governance approaches to three categories - one of market governance and two types of nonmarket governance: unilateral/hierarchical and bilateral (Heide, 1994) where bilateral governance includes many relational governance aspects. The governance theories, in this research primarily the TCE –rooted perspectives, provide a solid grounding for an ERM – focused research. The empirical findings related to the managerial situation and the intended managerial approach in the dyads are later analysed using the different forms of governance as the basis. The governance perspective, however, does not provide a very pragmatic foundation for the second part of the research question i.e. how the orchestration is manifested in the different situation. In order to identify the potential managerial practices for orchestration *a priori*, the orchestration –focused contributions as well as the more applied purchasing and supplier management literature are reviewed shortly next.

The concept of orchestration

The concept of orchestration is still vaguely defined, but some contributions exist. Hinterhuber (2002) defines orchestration as a way of creating and capturing value by structuring, coordinating and integrating activities. With the definition he captures a broad range of activities both from the perspectives of network configuration, i.e. selection of partner companies, and network management i.e. optimal resource utilization, and connecting the

orchestration concept to new value creation and new markets (Hinterhuber, 2002). Focusing on loosely coupled systems, Dhanaraj and Parkhe (2006) define orchestration in the context of an innovation network as a set of deliberate, purposeful actions undertaken by the hub firm as it seeks to create and extract value from the network. The orchestration activity is connected to loosely coupled innovation networks in a sense that no hierarchical controls exist in the relationship and the parties also preseve certain degree of independence. In the same way focusing on the innovation networks Ritala et al. (2009) follow mainly the perspective of Dhanaraj and Parkhe adding however the network design and recruitment perspective. They define orchestration as the capability to purposefully build and manage inter-firm innovation networks. From the supply chain management perspective, Vollmann et al. (2005) approach the orchestration concept by putting emphasis on facilitation and coordination aspects of the concept, and Choi & Krause (2006) connect the concept with increasing levels of outsourcing.

Management practices

Many of the management practices are associated with supplier integration, a discource motivated by realization of interdependence between the buyer and the supplier. Supplier integration is realized through practices that involve a combination of internal purchasing-manufacturing and external supplier related initiatives (Das et al., 2006) and also may involve a number of secondary activities that are concerned with value stream cohesion (Hines, 2008). A perspective closely related to the integration view is the perspective of coordination. Some authors, in fact, consider terms like *integration*, *collaboration*, *cooperation* and *coordination* complementary to each other (Arshinder et al., 2008). The discourses focusing on power and dependency, and later also the discourse around the concept of attractiveness, are addressing the management practices from capability point of view. The power/dependency theory (c.f. Cox, 2001) argues that the focal company power/dependency situation with its suppliers determines the ability of the focal company to manage its supplier relationships. The attractiveness discourse (Hald et al., 2009) in turn argues that this depends on the perceived attractiveness of the buyer.

The importance of practices related to strategic supplier base management and the strategic supplier base design is broadly acknowledged. Supply base design has been discussed mainly in relation to segmentation of supplier base and related use of purchasing portfolio-mapping techniques, which have been considered as the major breakthrough in the development of professional purchasing, simplifying a complex purchasing situation and helping companies to understand how to differentiate purchasing strategies (Gelderman and Semeijn, 2006; van Weele, 2005). However, the question of design between a buyer and a supplier is not limited to purchasing strategies and supplier selection only, but it includes also a question of interface specification between the buyer and then supplier (Araujo et al., 1999; 2016). Interfaces should be seen as resource contact points, where the design decisions can have implications to e.g. interaction and collaboration possibilities, productivity, innovation and mutual dependency in a buyer-supplier relationship (Araujo et al., 2016).

When moving on from strategy and design questions to existing buyer-supplier relationships, a related topic to supplier management and supplier integration is supplier development. Supplier development in general is a long-term cooperative effort between a buying firm and its suppliers to upgrade the suppliers´ capabilities and foster ongoing improvements (Watts and Hahn, 1993; Krause and Ellram, 1997; Sako, 2004). Supplier development discource involves a broad range of tangible managerial practices, that may be used by the focal company to influence and direct

the supplier. Furthermore, also operational dimensions like management of logistics and order fulfillment (Mentzer et al., 2001; Lee and Billington, 1992) form a part of management practices between a buyer and a supplier.

The Table 1 below summarizes managerial practices based on the extant literature. The identified practices are used in the empirical study as a priori constructs.

	A PRIORI CONSTRUCTS	INDICATORS	REFERENCES
MANAGEMENT PRACTICES	Design of end product and value proposition	Type of value creation strategy	Edelman and Heuskel, 1999; Brown et al., 2002; Hinterhuber, 2002; Möller et al., 2005; Dhanaraj and Parkhe, 2006; Ritala et al., 2009
	Architecture of Supply network structure	Number of alternative suppliers	Choi and Krause, 2006
		Type of external resources	Cox and Lamming, 1997; Hall, 2000; Cousins and Spekman, 2003
		Alignment of product, processes and supply chains	Fine, 2000
	Selection of Supply Network members	Supplier selection principles	Kraljic, 1983; Gelderman, 2003; van Weele, 2005
	Development of buyer-supplier relationships	Type of relationship	Dyer et al., 1998; Bensaou, 1998; Cousins and Spekman, 2003; Hines et al., 2000; Olsen and Ellram, 2003; Terpend et al., 2008
		Type of interface between buyer and supplier	Araujo et al., 1999; Dubois and Wynstra, 2005; Araujo et al., 2016
		Supplier development practices	Watts and Hahn, 1993; Hines, 1994; 2008; Krause and Ellram, 1997; Sako, 2004; Wagner, 2003
	Process Management over the supply chain	Process management practices	Menzer et al., 2001; Frohlich and Westbrook, 2002; Simchi-Levi et al., 2003; Handfield and Nichols, 2004;
	Supplier integration	Formal mechanism	Martinez and Jarillo, 1989; Trent and Monzcka, 1998; Swink et al., 2007; Williamson, 2008
		Informal mechanism	Martinez and Jarillo, 1989; Carter and Narashiman, 1993; Swink et al., 2007
	Coordination practices	Formal mechanism	Das et al., 2006; Arshinder et al., 2008
		Informal mechanism	Lee et al., 1997; Das et al., 2007

Table 1: Management practices in the extant literature, forming a priori constructs for the empirical study

Research design

Research approach

The purpose of the research reported here is to provide empirical insight into a relatively new concept, orchestration, which is investigated in context of external resource management. By nature this research is qualitative, and also inductive in nature, intending to provide novel contributions to external resource management discourse. To study the phenomenon the case study approach was selected, as case study research with its central notion to use cases as the basis from which to develop theory inductively (Eisenhardt and Graebner, 2007), is suitable for the objectives of the research. Selection of cases follows the theoretical sampling approach. In-depth access to the empirical data, which is critical for qualitative case studies, was the first

selection criterion. Access to data, as well as the necessary pre-understanding, was ensured through close interaction with the potential case companies during a preceeding research project and was futher confirmed through close interaction with the companies. The second level selection also followed the theoretical sampling, selecting from the longer list of potential companies those that were actively developing their supplier relationships, and which also were providing perspectives to different industries. Focus was all the time on manufacturing environment, but in order to mitigate a possible industry-specific bias, the case companies represent four different industry segments: Electronics, pharma, mechanical industry, and textile industry. The third level of selection comprises the selection of the buyer-supplier dyads. Together with each of the case companies, 2-3 buyer-supplier relationships were selected to closer investigation in addition to company-level data collection, summing up to 17 relationships in total. The selection criteria was similar to the case company selection: Access to relationship-specific data, development of the relationship, and diversity across industry segments were emphasized. All relationships, however, were considered to be strategically important by the case company, which may affect the generalization of the findings.

Case company details are reported in Table 1 below.

	Business	Revenue (MEUR)	Personnel	Reach
TelTech Inc.	Large globally operating electronics manufacturer having manufacturing plants in Europe, Asia and the US	>10000	60 000	Global operations and sourcing
Pharma Inc.	Develops, manufactures and markets pharmaceuticals, active pharmaceutical ingredients and diagnostic tests for global markets. An innovative European R&D-based company	770	3000	European based operations, global sourcing
CommTech Inc.	European-centric international electronics manufacturing, installation and service company	120	1200	Three manuf. locations (EU, China), global sourcing
HeavyMetal Inc.	Offers a range of machinery solutions in B2B market. Operations based on the combination of service network, leading technology and a focus on efficient supply chains	1700	10 000	Production facilities in 12 countries, global sourcing
Design Inc.	Design & brand consumer goods company with both own manufactured and subcontracted and traded goods portfolio (branded)	<100	400	European-centric operations, global sourcing

Table 1: The case companies (key figures by the time of research)

Situational factors

The governance view, as well as the network strategy and power/dependency perspectives, are forming the first category of a priori constructs in the research. They are used as constructs for empirical observation and analysis. Relationship management objectives are considered when analyzing the situational factors, motivated by realization that companies set targets not only for themselves but in many cases also for suppliers and for relationships they have or want to

have with their suppliers and other external resources. These objectives are in various ways guiding the efforts, resource usage and activities in that context.

	A PRIORI CONSTRUCTS	INDICATORS	REFERENCES
SITUATIONAL FACTORS	Focal company position in the value network	Stated position	Kraljic,1983; Bates and Slack, 1998; Gelderman, 2003
	Strategic focus areas	Focal company interest areas	Edelman and Heuskel, 1999; Hagel et al., 2002; Hinterhuber, 2002
	Approach to governance	Type of uncertainty	Williamson, 2000; 2008; Barney, 1999
		Asset specificity	Williamson, 2000; 2008; Barney, 1999
		Adaptation in a relationship	Williamson, 2000; 2008; Heide, 1994; Barney 1999;
		Type of contracting	Williamson, 2008; Ring and Van der Ven, 1992; Grandori, 2008
		Other safeguarding methods	Eccles, 1981; Powell, 1990; Ring and Van der Ven, 1992; Grandori, 2008
	Ability to influence	Power, dependency, attractiveness	Emerson, 1962; Stannack, 1996; Cox, 1999; 2001; 2004;

Table 1: A priori constructs used to observe and analyze the situational factors

Performance objectives

The performance objective constructs relate to performance focus on experienced or perceived performance of the external resources i.e. suppliers in the particular relationship. Depending on the maturity of the focal company in terms of performance management and supplier relationship management, the performance impact is assessed qualitatively, quantitatively, or both. However, a direct measurable relationship between management activities and business or operational performance is not provided, due to the complex nature of the phenomenon.

The performance constructs and their measurement are specified in the Table 3 below.

	A PRIORI CONSTRUCTS	INDICATORS
PERFORMANCE OBJECTIVES	Measurable key performance indicators	KPI's set for the relationships
		Actual performance
	Competitive factors	Defined objectives for the relationships
		Identified competitive factors

Table 2: A priori constructs used to observe and analyze performance objectives

Data collection

Collection of the empirical data took place through interviews and by participating as subject matter expert in the development projects in close collaboration with the companies. The first phase was conducted as an extensive in-depth case study in collaboration with the company in

multiple areas. It focused on the three supplier relationships and included 38 interviews, each with a duration of 2-3 hours, half- or full day workshops with the case companies, as well as more targeted meetings and reviews of the company internal material. Based on the case research, including comparison with literature, the first constructs were developed. For the second data collection phase, interviews were the main data collection methods. Like in the phase 1, the data collection was focused on the supplier relationships and on the overall company perspective. Data collection was more focused, and the interview structure was revised based on the interim observations at phase 1 and their comparison with literature. From the perspective of initial theorizing this research design including a two-part process, the revision of the research constructs based on empirical observations, and constant comparison between data and the constructs, is likely to enhance validity and generalizability (Eisenhardt, 1989). The phase three was based on the learnings from the two previous phases and was particularly focused on studying innovation sourcing. Also in Phase 3 the main data sources comprised interviews of selected key informants similar to the two previous phases. The data sources include company strategy documents, participation in workshops and meetings and internal documentation of the companies. To improve validity, the informants reviewed both the documentation from the intoerviews, as well as the company-level reports summarizing all the findings related to the case company and the investigated buyer-supplier relationships.

Data analysis

The data analysis began with case descriptions, introducing the focal companies and the embedded relationships with the suppliers. Based on the empirical case data supported by related literature review the buyer-supplier dyads were categorized according to their dominant governance approach and main focus and objectives. Following this categorization, the supplier base management practices in different business situations were identified. The practices of the focal companies were grouped under three broad categories and subcategories. The case descriptions were consolidated through cross-case analysis in order to identify cross-case patterns (Eisenhardt, 1989). A priori constructs, which were developed based on the literature review, were used as the dimensions of analysis and all case results were tabulated accordingly. A close fit and multiple iteration rounds between literature, a priori constructs, and empirical data, provided additional validity to theorizing.

The cross-case analysis focused on the perspectives of:

1. Situational factors, i.e. understanding potential similarities and differences in the managerial situations that the focal company is in.
2. Managerial practices that the focal company uses to orchestrate its external resources. Purpose of the cross-case analysis is to identify potential common patterns from the empirical data and connect the patterns to the respective managerial situation
3. Outcomes, i.e. objectives and performance that the focal company can achieve with its managerial practices in the particular situation

Results

The concept of orchestration is the starting point for this research. The key question is whether it exists in the first place, what it includes, what is the definition of orchestration, and whether orchestration is dependent on situation. First, the cross-case analysis reveals a clear pattern of intentional activities that the investigated focal companies are conducting with a purpose to

orchestrate the external resources. They are 1) positioning themselves in an influental position in a network 2) making efforts to architect the network, including supplier selections and design of the interfaces between them and the suppliers, 3) steering the buyer-supplier relationships, and 4) facilitating the performance through indicators and regular assessment and follow-up practices. The cross-case analysis table is included in Appendix 1. Developing the initial definition based on the empirical findings orchestration is defined as *an intentional act where a company is creating and capturing value by building, directing and leading networks of external resources.* Based on the empirical results, it can be further specified that orchestration is done through *orchestration practices, which relate to focal company positioning in a value network, to product and network architecture, to relationship management practices, and to facilitation of operative processes and performance.*

Second, the cross-case analysis reveals common patterns from the objective and performance indicator point of view. The case dyads can be divided to two categories pertaining to *cost efficiency focus*, and *focus on innovation*. The category *Cost efficiency focus* is related to overall cost efficiency orientation by the focal company, and emphasizes the aspects also towards the external resources. It may also include aspects of learning and knowledge transfer related to operational efficiency. From the target setting and performance management point of view indicators like cost, delivery accuracy, quality and asset efficiency are dominating. In turn, the category *Innovation focus* arises from the empirical data focusing on developing or capturing new innovations and added value for the focal company. Product/technology/service itself and related innovations, new business development aspects, competencies and capabilities for R&D, and new product development are emphasized in the innovation –oriented managerial situation. Product competitiveness, qualitative targets focusing on the relationship, and success in collaboration are clearly emphasized in target setting and performance indicators.

Third, comparison of the empirical observations with different forms of governance reveals a clear pattern with distinct differences related to questions of e.g. approach to contracting, and to design of the interface between the companies in a dyad. Summarizing the findings, either the approach is focused on *tight integration* between the companies, or alternatively it is intentionally respecting a clear-cut interface – *independence* - between the two companies. The *tight integration* approach includes characteristics such as long-term frame contracting, investments into relations-specific assets and resources, high level of adaptation and alignment by one or both of the parties, and clear focus on process and system integration cutting across the interface between the companies. The more clear-cut approach, where *independence* of the companies is either respected or even intentionally promoted for different reasons, has in turn characteristics of recurrent contacting, which may be even close to a market approach; it may include no investments into specific assets or resources and little adaptation, and focus is on low dependency and standardized interface between the companies with competition-dominant logic involved. The empirical observations could be connected to governance forms in slightly different ways; the best match the findings have with the classification introduced by Heide (1994), where he uses a division to bilateral and unilateral governance models to make a difference between governance approaches.

From the managerial situation –point of view the dyads can be arranged according to the dimensions of *relationship focus* – between cost and innovation, and *governance approach* – between bilateral and unilateral governance.

The situations and the position of each of the dyad is illustrated in the figure 1 below.

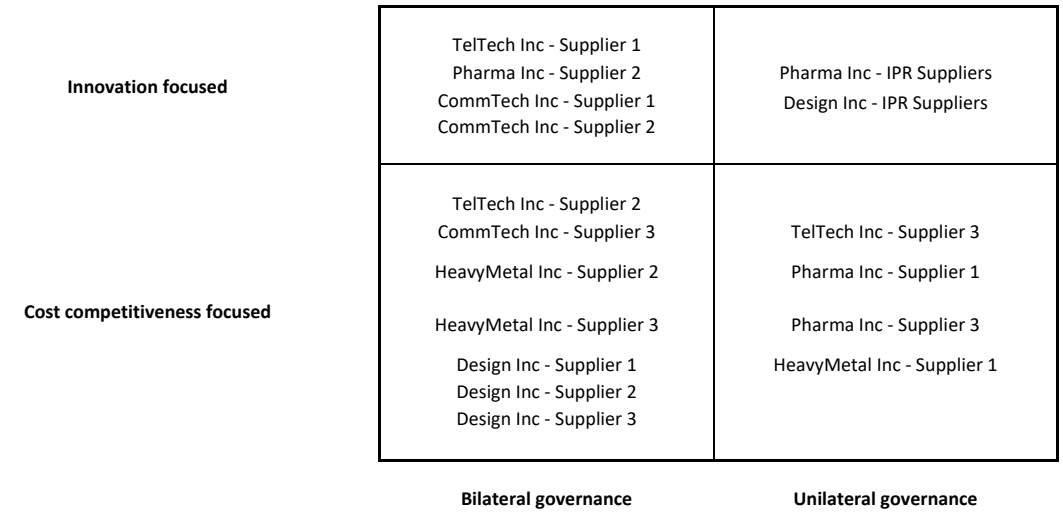

Figure 1: Identified managerial situations and the related case company / supplier relationships

The second part of the research question asks *how orchestration is manifested* in the identified managerial situations. In general, orchestration is manifested through managerial practices that can bne divided to four broader clusters: value positioning, product and network architecture, relationship management, and operative management. These clusters of practices form the basis for orchestration: the case companies are conducting activities in the four areas when they intend to orchestrate their external resources. The identified managerial practices not only provide insight into both how orchestration is manifesting itself in managerial work, but also provide insight into situational dependency of the practices i.e. into contigency view of orchestration.

The case company Pharma Inc provides an example of the managerial situations and the related profiles. The company has explicitly stated that they are owning the position at the consumer interface, and is integrating the product offering based on both own and contracted products. Sourcing strategy is directly derived from the business strategy, combining intentionally high value partner suppliers (like Supplier 2), innovation (IPR) suppliers, and lower value but high volume complementary product suppliers (Suppliers 1 and 3). The daily managerial approach differs sharply between the relationships, from a true innovation-focused, several decades long collaborative partnership with deep personal relationships to a market-based approach with clear-cut interface, cost and performance focus, location in low-cost country, and alternative suppliers continuously under evaluation. Similar patterns can be identified with other case companies as well. Following the earlier developed categorization of managerial situations, a management profile for each of the category is developed. The table 5 summarizes the profiles.

	Cost efficiency / Bilateral governance	Cost efficiency / Unilateral governance	Innovation / Bilateral governance	Innovation / Unilateral governance
Value positioning	Important	Important	Important	Important
Product and network architecture	Architecture enabling Supply Chain performance	Product architecture maintaining independence and competition	Product architecture integrating supplier innovation	Product architecture enabling absorbtion of supplier innovation
Relationship management	Institutionalized, formal relationships between organizations. Information sharing central	Relationships of independent actors. Formal and price/performance focused	Personal relationships. Shared values, trust and reciprocity central	Relationships formal and product performance focused. Parties see themselves independent
Operative management	High importance. Strong process integration	High importance. Independent operations, coordination focus	Done, relatively less important	Done, relatively less important

Table 5: Managerial situations and the related managerial profiles

From the performance point of view, the case companies having emphasis on cost efficiency as main focus, and respective managerial practices, perceive themselves being competitive in terms of operational efficiency. This competitiveness is visible e.g. through KPI:s like cost saving %, asset efficiency etc. which have been considered as being on good level. Those cases, in turn, where the focus has been on innovation and capturing of new value, the case companies perceive themselves generally being leaders in product and technology –related aspects, and less in light of cost efficiency -focused aspects. As a summary, the main practices are plotted to the managerial situation –matrix.

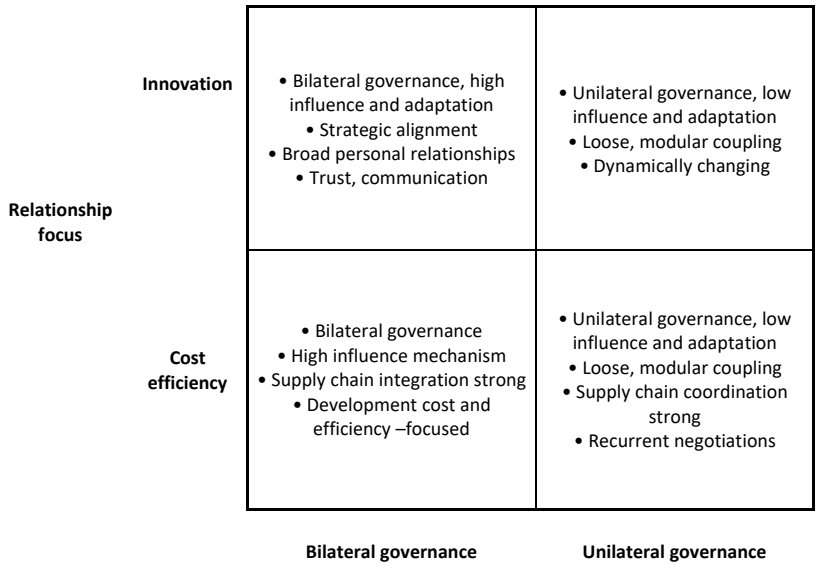

Figure 2: Identified managerial situations and the managerial profiles

Discussion and conclusions

The objective of this paper is to clarify the concept of orchestration, and to identify how orchestration is manifested in different managerial situations. The main contribution relates to the empirical findings, which are providing further insight into the orchestration concept itself, into the managerial approaches that are a part of orchestration, and also into the context-

dependency of orchestration. Furthermore, the results provide an empirical view into how the design of a buyer-supplier interface relates to the managerial situation at hand.

Focusing on the concept of orchestration, the results demonstrate that orchestration concept is relevant from the external resource management point of view and can be identified empirically. The research highlights structuring, coordinating and integrating activities, as identified e.g. by Hinterhuber (2002), by e.g. Choi et al. (2001), and which are also the main focus in e.g. coordination theory and in supply chain management, but proposes that the aspects of value creation strategy, recruitment of network members, and the architectural aspects should be included into the orchestration concept. This research also proposes that the activities focusing on the overall value creation system relate to positioning of the focal company in the value system, and to the architecture of the product and supplier network as a whole.

The classification of external resource management situations according to focus i.e. *innovation vs. cost efficiency*, which as such is not new, combined with the *governance approach* is a key contribution, in particular the feasibility of bilateral and unilateral governance approaches (Heide, 1994), and utilization of them to structure the managerial approach towards external resources. Both of the governance types were observed in the cases and were explaining many of the differences in the management approaches in the case relationships. By classifying the managerial situations in the proposed way, it is possible to gain a view on the requirements and success criteria for effective management of external resources in the identified situations, incorporate the target orientation of the focal company to the situations, and to create differentiated managerial approaches with a good fit to the managerial situation at hand.

The supplier management situations have been extensively discussed and analyzed in the purchasing literature in the context of different portfolio models, which are particularly relevant for the design of the overall external resource base. Affecting the focal company orchestration capability, major issues that appear are strategic positioning of buyer and supplier, highlighted through the dependency discussion and through different portfolio models (see e.g. Kraljic, 1983; Gelderman, 2003) as well as the perspective of buyer-supplier relationships, which has an extensive management literature stream of its own (e.g. Dyer et al., 1998; Bensaou, 1999). The portfolio models focused on the supplier relationships (e.g. Bensaou, 1999; Cox, 2004) appear as a useful framework in this research. The managerial situation –matrix introduced in this paper contributes to the discourse by bridging the managerial situation with the activities; this connection cannot be done with the existing portfolio models, which focus on more strategic or relationship perspectives.

It can also be argued that the intended governance model affects the approach that the focal company can and should have towards a supplier in terms of interface definition, relationship management approach and integration and coordination methods. Based on this study it is possible, for instance, to identify a group of key suppliers where tight integration may be desirable: the strategic supplier relationships where a stable, long-lasting relationship is expected, and where at the same time the primary objective of the relationship is joint operative efficiency in the supply chain. The research is aligning well with the typology of interfaces introduced by Araujo et al. (2009; 2016), suggesting also that the interface design is critical for successful orchestration. In this respect, there is also an analogy with the classical approach of distinguishing between arms-length and partnership approaches (Dyer and Singh 1998), with the same intention to promote balanced utilization of both strategies. The findings also provide managerial guidance for determining an appropriate management style, actions and resources for supplier base management. The managerial practices differ, however, for example from the

supply management practices identified by Lawson et al (2009), who name socialization activities, process integration, and supply base responsiveness as practices facilitating effective buyer-supplier relationship performance. Their findings indicate support for performance in a way that has similarities to cost efficiency/bilateral governance -related managerial profile.

The concept of innovation sourcing is not completely new, but is not yet extensively discussed in purchasing and supply management discourse. There are several perspectives in the process of capturing external innovation and integrating it into a company offering. The first perspective is the discussion on open vs. proprietary innovation (Chesbrough 2006). Also Phillips et al. (2006) address the need for supply relationships to generate and support discontinuous innovation. They are suggesting that for discontinuous innovation, it may in a firm´s best interest to develop a broad range of non-committal supply relationships, in concurrence with longer-term strategic partnerships. Findings from this research identify the related orchestration situation and propose a feasible managerial profile. The results also suggest that in addition to the involvement of suppliers in innovation processes, there is room for further actions from the point of view of external sourcing of radically new, even discontinuous innovations.

The last notable contribution is the insight regarding the architectural processes in supplier selection and in designing an effective supply network. It can be argued that product architecture and technology selections may affect strongly the ability to develop a desired buyer-supplier relationship. In a similar way, several of the case companies were using the product and technology architecture closely related to sourcing strategy. The focal company must determine whether it wants to proceed in close collaboration with the selected supplier in a rather permanent relationship, or whether it wants to use suppliers in more dynamic and competitive way. In both cases, the technology strategy and sourcing strategy are closely intertwined. These findings are consistent with the extant literature (e.g. Fine 2000; Fixson 2005; Araujo et al. 2016), highlighting the interplay between technology strategy and the buyer-supplier interfaces, as well as the importance of concurrent design of product, process and the supply chain also for successful supplier base management.

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Appendix 1: Cross-case analysis of Managerial Practices

MANAGERIAL PRACTICES		Design of the end product and value proposition	Architecture of product and network structure	Selection of network members	Development of buyer-supplier relationships	Process management over the supply chain	Supplier integration	Coordination practices
Innovation focused - Bilateral governance	**TelTech Inc - Supplier 1**	Business model and value creation specification	Product and technology strategy and architecture Communication of technology selections		Evaluation and feedback, Policies and KPI:s, certification and evaluation	Facilitation of supply chain performance	Formal mechanisms Asset-specific investment Process and system integration	Information exchange facilitation of operative performance
	Pharma Inc - Supplier 2	Value chain design		Sourcing and selection emphasized	Joint development projects Relational capital development Joint problem solving	Shared performance monitoring and management	Process integration. Informal integration mechanisms	Written policies and procedures Information exchange Facilitation of operative performance
	CommTech Inc Supplier 1	Design of end product and value proposition	Design for Excellence	Value-based selection of suppliers	Informal mechanisms Personal relationships driving collaboration			Intensive information sharing
	CommTech Inc Supplier 2	Design of end product and value proposition	Design for Excellence	Value-based selection of suppliers	Informal mechanisms Personal relationships driving collaboration			Intensive information sharing
Innovation focused - Unilateral governance	**Pharma Inc - IPR Suppliers**	Definition of value creation logic		Sourcing and selection emphasized	Marketing business potential			Management of personal relationships
	Design Inc - IPR Suppliers	Design of the value proposition			Personal relationship management efforts Relational capital development efforts		Informal mechanisms	Information exchange
Cost competitiveness focused - Bilateral governance	**TelTech Inc - Supplier 2**	Business model and value creation specification		Strong product and supply base design focus	Supplier development resources	Facilitation of supply chain performance	Formal mechanisms Process and system integration	Information exchange Facilitation of operative performance
	CommTech Inc Supplier 3	Design of end product and value proposition	Design for Excellence	Value-based selection of suppliers	Informal mechanisms Personal relationships driving collaboration			Intensive information sharing
	HeavyMetal Inc - Supplier 2	Definition of value creation logic	Product architecture to reduce dependency Architecture of supply base Network achitecture driving supplier proximity	Clear definition of procurement strategy and category strategies	Introduction of alternative suppliers, competititon			Formal mechanisms Information exchange Facilitation of operative performance
	HeavyMetal Inc - Supplier 3	Definition of value creation logic	Product architecture to reduce dependency Architecture of supply base Network achitecture driving supplier proximity	Clear definition of procurement strategy and category strategies	Introduction of alternative suppliers, competititon			Formal mechanisms Information exchange Facilitation of operative performance
	Design Inc - Supplier 1	Design of the value proposition	Strong ownership about the product design and image	Active sourcing and selection of alternative suppliers				Information exchange facilitation of operative performance
	Design Inc - Supplier 2	Design of the value proposition	Strong ownership about the product design and image	Active sourcing and selection of alternative suppliers	Personal relationship management efforts		Informal mechanisms	Information exchange facilitation of operative performance
	Design Inc - Supplier 3	Design of the value proposition	Strong ownership about the product design and image	Active sourcing and selection of alternative suppliers				Information exchange facilitation of operative performance
Cost competitiveness focused - Unilateral governance	**TelTech Inc - Supplier 3**	Business model and value creation specification	Product and technology strategy and architecture		Supplier development resources		Formal mechanisms	Information exchange facilitation of operative performance
	Pharma Inc - Supplier 1	Value chain design		Sourcing and selection emphasized				Written policies and procedures Information exchange Facilitation of operative performance
	Pharma Inc - Supplier 3	Value chain design		Sourcing and selection emphasized			Supplier integration and coordination, like sharing of critical information	Written policies and procedures Information exchange Facilitation of operative performance
	HeavyMetal Inc - Supplier 1	Definition of value creation logic	Product architecture to reduce dependency Architecture of supply base Network achitecture driving supplier proximity	Clear definition of procurement strategy and category strategies	Introduction of alternative suppliers, competititon			Formal mechanisms Information exchange Facilitation of operative performance

Strategic alliances for sustainability: An embedded multiple case study

Sabrina Lechler

Research fellow, Chair of Supply Chain Management, Friedrich-Alexander University Nuremberg, Lange Gasse 20, 90403 Nuremberg, Germany, E-mail: sabrina.lechler@fau.de, Phone: +49 (0) 911/5302 – 454, Fax: +49 (0) 911/5302-460

Dr. Angelo Canzaniello

Guest Researcher, Chair of Supply Chain Management, Friedrich-Alexander University Nuremberg, Lange Gasse 20, 90403 Nuremberg, Germany, E-mail: angelo.canzaniello@googlemail.com, Phone: +49 (0) 911/5302 – 444, Fax: +49 (0) 911/5302-460

Prof. Dr. Evi Hartmann

Chair-Holder, Chair of Supply Chain Management, Friedrich-Alexander University Nuremberg, Lange Gasse 20, 90403 Nuremberg, Germany, E-mail: evi.hartmann@fau.de, Phone: +49 (0) 911/5302 – 444, Fax: +49 (0) 911/5302-460

Abstract

The paper addresses the challenge of managing first-tier as well as lower-tier suppliers with respect to sustainability in order to prevent reputational damage for focal companies. We contribute to this field by examining assessment sharing strategic alliances (ASSAs) as a means of increasing suppliers' compliance with corporate sustainability standards (CSSs). More specifically, we present findings of an embedded multiple case study conducted in the railway, telecommunication and pharmaceutical industry. Our results confirm that ASSAs generally improve suppliers' compliance with focal companies' CSSs. However, the degree of improvement substantially depends on the configuration of the respective ASSA.

Keywords: Strategic Alliance Multi-Tier Supplier

Introduction

"Apple, Samsung and Sony face child labor claims" – Headlines like this often cause high reputational damage for the accused companies and should therefore be avoided by any means. In this specific case, the human rights organization Amnesty accused the citied companies of failing to carry out investigations to ensure that minerals used in their products are not mined by children. As became apparent, the appealed violations could not be directly linked to those companies and did not take place directly with the companies' assigned first-tier suppliers. Nevertheless, they were held responsible for these violations committed far upstream of their

supply chain by their suppliers' suppliers. This phenomenon is referred to as *chain liability effect* by Hartmann and Moeller (2014), meaning that consumers hold the focal company responsible for everything that occurs in its supply chain. This observation and the fact that many serious sustainability violations are committed further upstream of the supply chain (Tachizawa and Yew Wong, 2014) highlight the importance of extending the management of first-tier suppliers to sub-suppliers in order to effectively manage sustainability-related risks in multi-tier supply chains (MSCs) (Wilhelm, Blome, Wieck and Xiao, 2016). Thus, we equally consider the management of first-tier suppliers and sub-suppliers when discussing multi-tier supply chain management (MSCM) in the following.

Triggered by the high complexity of managing an increasing number of suppliers with respect to sustainability to meet stakeholders' growing sustainability expectations (Fayezi, O'Loughlin and Zutshi, 2012), assessment sharing strategic alliances (ASSAs) between competitors of the same industry are formed in the real-world context. The aim of these alliances is the exchange of sustainability audit reports of common suppliers in order to collaboratively safeguard suppliers' compliance in MSCs. Strategic alliances are generally defined "as voluntary arrangements of at least two companies involving the exchange, sharing and co-development of [resources or capabilities]" (Gulati, 1998, p. 293). These predominantly emerge in uncertain and complex business settings (Lin and Darnall, 2015) in order to create values that cannot be achieved isolated and independently by one single company (Dyer and Singh, 1998). Even though strategic alliances are a long-existing object of investigation in the scientific world (Beamish and Lupton, 2016), in the context of sustainable supplier management, recent research has mainly investigated vertical alliances between a focal company and its first-tier suppliers. Thus far, little attention has been put on horizontal strategic alliances in the context of sustainable supplier management. This may be explained by the fact that the formation of strategic alliances between competitors of the same industry is a recent phenomenon in the real-world context (Canzaniello, Hartmann and Fifka, 2017), which is additionally triggered by the increasing complexity of involving lower-tier suppliers in sustainable supplier management practices.

Although an embedded single case study in the chemical industry has already been conducted to observe the motivations of companies to form or join an ASSA and to reveal outcomes of ASSAs on sustainability-related supplier risks (Canzaniello et al., 2017), ASSAs as a means of implementing sustainability to MSCs have thus far not been studied. In this context, questions arise as to how supplier management practices are performed collaboratively among the alliances' members within ASSAs and which effects result from these collaborative activities on the MSCM for sustainability. In order to address this research gap, we formulate the following two research questions:

- **RQ1:** How do companies collaborate within ASSAs to manage suppliers within MSCs with respect to sustainability?
- **RQ2:** Which effects do ASSAs have on the management of suppliers within MSCs with respect to sustainability?

As there is no research yet that has investigated ASSAs in the context of MSCM, our research is explorative, aiming at elaborating existing theory, more precisely agency theory (AT). This is realized through the conduction of an embedded multiple case study (Ketokivi and Choi, 2014). For this purpose, we study the collaboratively utilized supplier management practices of three ASSAs from three different industries (railway, telecommunication and pharmaceutical) and explore the effects of their settings on the management of MSCM for sustainability by consideration of typical principal-agency constructs.

The remainder of this paper is structured as follows: first, we outline the theoretical background relating to our posed research questions. Next, our research methodology is discussed, which is

followed by the analysis and discussion section, where the results of our comprehensive cross-case analysis are represented and discussed. Finally, we close with a summarizing conclusion, where study limitations and future research avenues are highlighted.

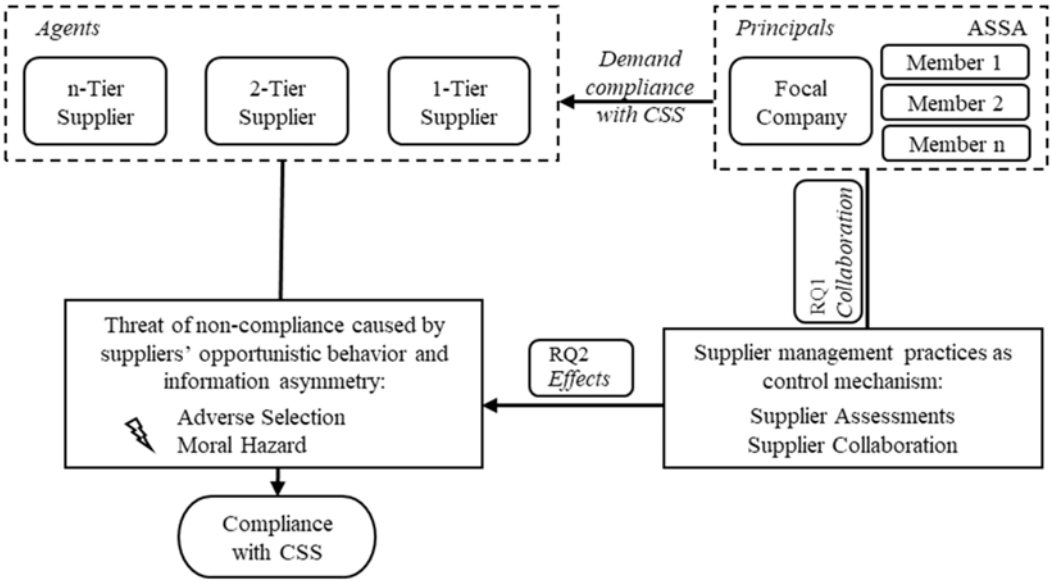
Theoretical background

The ongoing cost-oriented outsourcing trend from so-called low-wage countries, which frequently goes hand-in-hand with unacceptable environmental protection and inappropriate working conditions on the respective supplier sites (Mueller, dos Santos and Seuring, 2009), has continuously increased the public attentiveness to corporate environmental and social engagement (Martin, 2002; Schmidt, Foerstl and Schaltenbrand, 2017). Consequently, the management of suppliers with respect to sustainability is gaining increasing importance to prevent negative publicity and the reputational damage associated therewith (Carter and Jennings, 2004). However, most sustainability violations are not committed by first-tier suppliers but further upstream of the supply chain by lower-tier suppliers (Tachizawa and Yew Wong, 2014). Therefore, both direct suppliers and sub-suppliers have to be managed with respect to sustainability in order to effectively manage sustainability-related risks (Wilhelm et al., 2016).

Grimm, Hofstetter and Sarkis (2014) observed that practices that are used to manage sub-supplier are similar to those applied to first-tier suppliers, which were previously classified by Vachon and Klassen (2008, 2006) into *assessment* and *collaboration practices*. Thereby, assessment practices (e.g. sustainability standards, social and environmental audits) are executed to gather information and evaluate suppliers' sustainability performance, while collaboration practices (e.g. supplier development through training, workshops and resource transfer) are applied to improve suppliers' sustainability performance (Klassen and Vachon, 2003; Vachon and Klassen, 2006, 2008). Moreover, Grimm, Hofstetter and Sarkis (2016) revealed that the active management of both assessment and collaboration practices can improve sub-suppliers' compliance with corporate sustainability standards. However, approaching lower-tier suppliers is more defiant than approaching first-tier suppliers due to sub-supplier specific characteristics (Grimm et al., 2014; Tachizawa and Yew Wong, 2014). This is, among other things, due to the fact that focal companies do not have contractual relationships with their lower-tier suppliers and consequently possess less information about their sub-suppliers (Choi and Hong, 2002). Moreover, their influence over sub-suppliers is lower since dominant buyers often only represent a small percentage of the lower-tier supplier's business (Plambeck, Lee and Yatsko, 2012; Tachizawa and Yew Wong, 2014).

According to Tachizawa and Yew Wong (2014) there are three strategies that can be applied to approach sub-suppliers. The first one is the *direct approach*, where sub-suppliers are managed by the focal company itself, the *indirect approach*, where focal companies rely on their first-tier suppliers to manage their lower-tier suppliers and the *work with others approach* on which we focus in our research paper. The *work with others approach* can be realized in two ways. First, responsibilities of managing lower-tier suppliers can be delegated to other organizations, such as NGOs, competitors or firms from the same industry (Tachizawa and Yew Wong, 2014). Second, strategic alliances can be built with competitors or firms from the same or other industries in order to improve negotiation power over lower-tier suppliers and to manage sub-suppliers collectively (Tachizawa and Yew Wong, 2014). Through the examination of ASSAs from a sustainability perspective, the *work with others approach* will be investigated in more detail by revealing how this strategy is implemented in practice. Moreover, to better understand how ASSAs affect suppliers' compliance with CSS, agency theory is applied as our theoretical anchor. This theory was chosen as it is suitable for analyzing how to cope with risks that arise when one party (principal) delegates work to another party with conflicting goals (agent) (Eisenhardt, 1989a; Jensen and Meckling, 1976). In this context, the misrepresentation of the agent's capabilities (adverse selection) and the lacking effort of the agent to meet the principal's

requirements (moral hazard) (Eisenhardt, 1989a) are the most significant problems that occur in agency relationships (Ciliberti, Haan, Groot and Pontrandolfo, 2011). Both constructs can be related to agents' opportunistic behaviour and to information asymmetry between the agent and the principal, which makes it difficult for the principal to evaluate if the agent is behaving in accordance with the principal's requirements (Eisenhardt, 1989a). To prevent these problems, the principal can either implement information systems to reveal the agents' behaviour or reward outcomes which aligns the agent's preferences with those of the principal (Eisenhardt, 1989a). In the context of sustainable supplier management, the buyer (representing the principal) delegates work to suppliers (representing the agents) and is thus exposed to sustainability related-risks due to agents' opportunistic behaviour (Hajmohammad and Vachon, 2016). Consequently, adverse selection occurs when suppliers' sustainability-related capabilities are misinterpreted in the supplier selection process, whereas moral hazard refers to suppliers' lacking efforts to meet the required CSS of the focal company. In order to prevent the accompanying sustainability related risk, supplier management practices can function as control mechanisms (Hajmohammad and Vachon, 2016). Thereby, assessment practices can be regarded as a focal company's information system, which is utilized to gather sustainability-related information and to evaluate suppliers' sustainability performance (Klassen and Vachon, 2003; Vachon and



Klassen, 2006, 2008). Thus, richer information on the agents' behavior can be gathered, which increases the likelihood that the agents' behavior is consistent with the principal's interests (Eisenhardt, 1989a). Furthermore, collaboration practices are applied to encourage a sustainable culture and to improve suppliers' sustainability capabilities (Hajmohammad and Vachon, 2016; Klassen and Vachon, 2003; Vachon and Klassen, 2006, 2008). However, the detection of agents' behavior gets even more challenging when a multi-tier perspective is considered, as an increased number of heterogeneous agents has to be considered (Fayezi et al., 2012). Thus, our study extends existing agency theory by applying it in a strategic alliance context in order to investigate how control mechanisms can be applied collaboratively by members of ASSAs (RQ1) and to reveal how the collaborative execution of these control mechanism affects the management of suppliers in MSCs (RQ2). Figure 1 illustrates the theoretical framing of our research questions grounded in AT.

Source: adapted from Eisenhardt (1989a), Hajmohammad and Vachon (2016), Klassen and Vachon (2003), Vachon and Klassen (2006, 2008)
Figure 1. Underlying research framework

Research methodology

In order to address our two research questions, an embedded multiple case design was applied to collect empirical data. This method is suitable for our research endeavor as research on ASSAs for sustainability is still in an exploratory stage and existing knowledge of the effects of strategic alliances on the MSCM is scarce, as described previously (Benbasat, Goldstein and Mead, 1987; Yin, 2014). Moreover, in contrast to broad empirical research, this approach allows a closer investigation of theoretical constructs and the exposure of the underlying causal relationships (Siggelkow, 2007). Thus, a comparative comprehensive understanding of the nature and complexity of the studied phenomenon can be achieved (Benbasat et al., 1987).

Case selection

Because the number of ASSAs within sustainable supply chain management is still low, the potentially selectable amount of cases was limited. Thus, our research focused on three ASSAs from three different industries. Three alliances were chosen, as it seemed more reasonable to consider several ASSAs in order to demonstrate how companies collaborate within ASSAs to manage suppliers within MSCs with respect to sustainability. Moreover, through the consideration of three different ASSAs, differences between their configurations could be derived and the effects of those varying configuration options on the management of suppliers in MSCs could be determined. Therefore, we ensured that the chosen ASSAs were not too similar in terms of their design of supplier management practices. Moreover, we only considered ASSAs which were founded fewer than ten years ago, as interviews with employees who were directly involved in the formation of or accession in the ASSA could be interviewed. Thus, we selected ASSAs from the railway, telecommunication and pharmaceutical industries as the cases for our research endeavor. Three members companies from every alliance agreed to participate in our study, which are presented in Table 1. Additionally, publicly available secondary data, such as press releases and corporate sustainability reports of those member companies that did not participate in our study, were taken into consideration in order to test whether additional information would provide further insights which could not be revealed by data generated through the interviews of the participating companies. Since no additional relevant data were revealed, the non-existence of a potential non-response bias could be confirmed.

	Alpha			Beta			Gamma		
	$Alpha_A$	$Alpha_B$	$Alpha_C$	$Beta_D$	$Beta_E$	$Beta_F$	$Gamma_G$	$Gamma_H$	$Gamma_I$
# direct suppliers [in 1.000]	> 16	> 13	> 30	> 30	> 80	> 12	> 110	> 110	> 60
# interviews	3	2	2	3	2	2	2	2	3
# informants	3	2	2	2	2	2	2	2	2

Table 1. Overview of cases and interviewed companies

Data collection

Multiple sources of evidence were taken into account in order to ensure high construct validity in the data collection process (Eisenhardt, 1989b; Gibbert, Ruigrok and Wicki, 2008; Yin, 2014). Data gathered from semi-structured interviews with key informants from the different member companies were used as a primary data source. In this context, an extensive review of relevant literature was conducted in order to develop the interview guideline. The interviews were executed with informants from the sustainability management or procurement departments of the participating companies, as employees of these departments have the most points

of contact with the respective alliance, since they actively shape its configuration and work processes. For reason of triangulation, at least two informants per company were interviewed (Eisenhardt and Graebner, 2007) and additional interviews were requested until further interviews did not reveal further insights (Yin, 2014). In total, 21 interviews were conducted in the period between June 2016 and May 2017. In addition, secondary data were used for triangulation purposes in order to increase internal validity. Therefore, corporate material of the interviewed companies (e.g. supplier codes of conducts, annual reports, corporate sustainability reports) and material from the ASSAs (e.g. process guidelines, self-assessment questionnaires, audit templates) were triangulated with the insights gained from the interviews. In conclusion, we set up a case study database in order to increase reliability (Gibbert et al., 2008; Yin, 2014).

Data analysis

The analysis of the collected data comprised two key steps. First, a within-case analysis was conducted to understand the individual ASSA approaches. Second, common patterns across and differences between the three cases regarding supplier management practices and their effects on supplier management were revealed through a cross-case analysis. To begin with, a within-case description of each of the three cases was drawn up in order to capture all relevant information about the supplier management practices of the three ASSAs with respect to sustainability. Next, a coding process was applied to identify structures and patterns in the unstructured qualitative data gathered through the conducted interviews (Strauss and Corbin, 1990; Yin, 2014). After the individual coding procedures of the two researchers were completed, the coding results were then discussed and compared with all members of the research team. This discussion was conducted until all inconsistencies were eliminated and final agreement among the researchers was achieved. Thus, a potentially inherent investigator bias could be reduced and inter-rater reliability could be ensured. Finally, following our theoretical framework, a cross-case analysis was conducted in order to identify common characteristics of and differences between the investigated ASSAs regarding their collaborative supplier management practices and to derive the effects of different ASSA configurations on supplier management within MSCs (da Mota Pedrosa, Naeslund and Jasmand, 2012; Eisenhardt and Graebner, 2007).

Results

Although the sharing of assessment results is an integral part of all three investigated ASSAs, differences between the investigated ASSAs regarding the execution of their assessment and collaboration practices could be observed (see Table 2). Moreover, due to the varying design and execution of those control mechanisms among the three alliances, different effects on the management of suppliers within MSCs with respect to sustainability could be identified.

The assessment of the sustainability performance of suppliers within MSCs is a very time-consuming and cost-intensive process (Foerstl, Reuter, Hartmann and Blome, 2010; Grimm et al., 2014), especially for companies which are not organized in ASSAs. Consequently, only a small number of suppliers and an even lower number of sub-suppliers were assessed by companies prior to their accession to an ASSA. With this complex setting in mind, companies within an industry decided to found or join an ASSA in order to be more effective in assessing the sustainability performance of their suppliers. Within all investigated ASSA, a standardized assessment process based on collectively accepted requirements is used to measure the sustainability performance of suppliers within MSCs. Moreover, a supplier is assessed by only one member company and the assessment results are shared between the members of the strategic alliance, as can be seen in Figure 2.

As a result, assessment costs as well as workload for the alliance's members are reduced through all three investigated alliances' settings. However, the setting of all three ASSAs does not only lead to efficiency gains for the members of the alliances, but also for their suppliers. Due to the fact that the results of sustainability assessments are shared among the members of an alliance, suppliers only receive one single assessment request from one of the member companies. Thereby, suppliers have to perform a reduced number of assessments. The efficiency enhancement on the suppliers' side not only raises the willingness of suppliers to accept and perform assessments, as $Alpha_A$'s head of international procurement and $Alpha_A$'s corporate sustainability expert confirmed, but also to share sustainability-related information with an increased number of their customers through the alliances' shared audit pool, as the head of sustainability of $Gamma_G$ stated.

Case	Alpha	Beta	Gamma
Industry	Railway	Telecommunication	Pharmaceutical
Year of foundation	2015	2010	2006
# of founding members	6	3	7
# of members	8	13	24
Membership open to	Railway operators and companies across the railway industry	Telecommunication operators	Pharmaceutical or healthcare companies
Membership requirements regarding SSM	Subscription to third party assessment platform Initiation of 100 supplier assessments or 60% of relevant procurement spend	Execution of five on-site audits on behalf of the alliance through a third party auditing company	Active participation in the alliance including the shared audit program and working committees Execution of five on-site audits per years
Control mechanisms			
Supplier assessment	Assessment of the suppliers' sustainability performance through a common assessment tool provided by a third party provider	Assessment of the suppliers' sustainability performance through on-site audits based on standardized audit guidelines	Assessment of the suppliers' sustainability performance through common self-assessment questionnaires and on-site audits based on standardized audit guidelines
Assessment performed by	Third party provider	Third party auditing firm	Third party auditing firm or members' internal auditors
Nomination for assessments	At discretion of members	Only those supplier which are engaged with a predefined minimum number of the initiative's members are nominated for a common audit	At discretion of members
Result sharing	Assessment results are not automatically visible to all member companies Suppliers can decided with whom they share their audit results	Before an audit is performed, suppliers have to agree to share the audit report to all members of the alliance Audit reports are automatically shared among all members	Supplier and audit leading member company have to agree to share the audit report Suppliers can decided with whom they share their audit results
Costs	Costs are paid by the supplier	Costs are paid by the audit leading member of the initiative	Costs are paid by the audit leading member of the initiative or by supplier themselves, in the case that they nominated themselves for the audit
Supplier collaboration	Members' individual business	Follow-up process to resolve audit findings is part of the alliance's joint auditing process Supplier development exceeding the follow-up process is not part of the initiative's processes	Follow-up process to resolve audit findings is part of the alliance's joint auditing process Capability building program to build supplier knowledge and expertise regarding sustainability issues is part of the initiative's activities

Table 2. Collaborative supplier management practices of investigated ASSAs

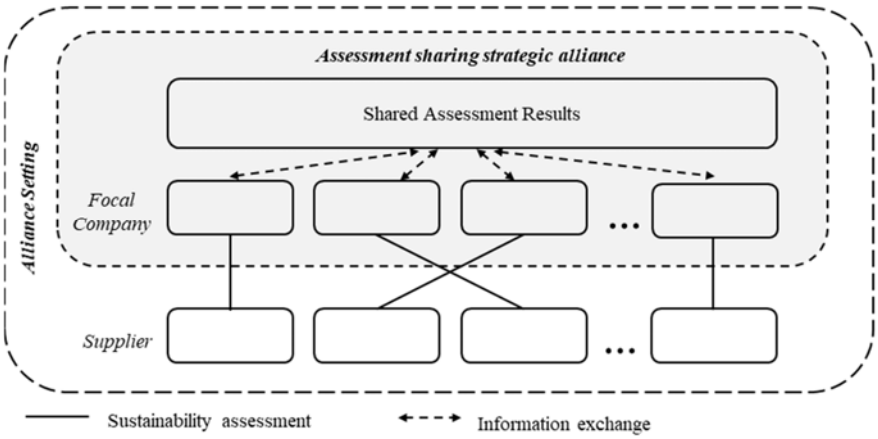


Figure 2. Schematic representation of an alliance setting

In addition, suppliers use the respective ASSA as a platform to promote their good sustainability performances to their customers, as Alpha$_A$'s corporate sustainability expert stated. Thus, the incentives for suppliers with a good sustainability performance to perform sustainability assessments increase. Moreover, the willingness of poorly performing suppliers to improve their performance and to share updated sustainability-related information through re-assessments is fostered. The execution of voluntary sustainability assessments and re-assessments requested by suppliers themselves, which were reported by Alpha$_A$'s corporate sustainability expert, Alpha$_C$'s sustainable procurement expert and Gamma$_I$'s supplier performance expert, confirm those statements.

If a sustainability assessment reveals any sustainability violation, Beta's and Gamma's assessment leading companies have to execute subsequent follow up-processes on behalf of the alliance to address suppliers' shortcomings. Thus, suppliers no longer see assessments as surveillance actions. This is due to the fact that these follow-up processes do not solely include a re-assessment after a predefined period of time, but a collaborative development of corrective action plans together with the audit leading company. Moreover, in comparison to follow-up processes organized by non-member companies, the quality of the member companies' proposed corrective actions is monitored within the alliance, which allows the exchange of good and bad solution approaches to resolve sustainability-related issues, as the head of supplier performance of Beta$_E$ stated. Therefore, suppliers consider the proposed corrective actions of alliances' members as very valuable to improve their sustainability performance, leading to additional business in the future, as Gamma$_I$'s sustainability expert confirmed.

Moreover, the execution of follow up-processes on behalf of the alliance also enables sharing of expenses and effort involved in follow-up processes among the member companies of Bata and Gamma, since the improvement of suppliers' sustainability performance is not at each company's discretion like it is for Alpha's members. Moreover, Gamma even deploys a joint supplier development program, which is an integral part of the alliance's activities. Thus, supplier workshops and webinars are organized and performed with the involvement of several member companies, and therefore allowing cost savings, as Gamma$_G$'s head of sustainability management stated. Moreover, it is more effective to work together with other member companies to address certain issues, as the sustainability procurement expert of Gamma$_G$ confirmed. Consequently, supplier collaboration activities can be performed more efficiently from a single companies perspective, as process inputs (collaboration costs and workload) are reduced while collaboration outputs (number of approached suppliers) increase.

Since serious sustainability violations are mainly committed by sub-suppliers, the focus of at least some of the interviewed companies has already shifted further upstream of the supply chain, as Alpha$_C$'s sustainable procurement director, Beta$_E$'s head of supplier performance and

the sustainable supply chain expert and the head of procurement strategy and corporate responsibility of Beta$_D$ confirmed. Particularly in the telecommunication industry, first-tier suppliers are now rarely producing directly, and so the consideration of lower-tier suppliers is essential, as the head of supplier performance of Beta$_E$ stated. Therefore, by 2015, 84% of the performed audits of Beta pertained to subcontractors. However, the hurdles of managing sub-suppliers usually make it necessary to work closely with the first-tier supplier in order to manage upstream suppliers with respect to sustainability, as Beta$_D$'s sustainable supply chain expert stated. However, due to the membership structure of Alpha and Gamma, it is not absolutely necessary for focal companies to contact lower-tier supplier in order to ensure their compliance with CSS. Since membership of these two alliances is open to suppliers as well, reports of assessments of lower-tier suppliers, which were conducted by participating first-tier suppliers, are available for the focal company without any direct contact with their sub-suppliers, as Alpha$_A$'s procurement strategy expert explained. Thus, the transparency of MSCs on various tiers can be increased, as Figure 3 demonstrates. Moreover, according to the sustainability procurement expert of Gamma$_G$, the alliance is also a good platform for suppliers, which are members of the respective ASSA, to exchange best practices with other member companies in order to improve their own sustainability knowledge. Thus, those suppliers can pass on the sustainability principles of the respective alliance to their suppliers, whereby second-tier or even third-tier suppliers can be reached, as Gamma$_I$'s sustainability expert stated.

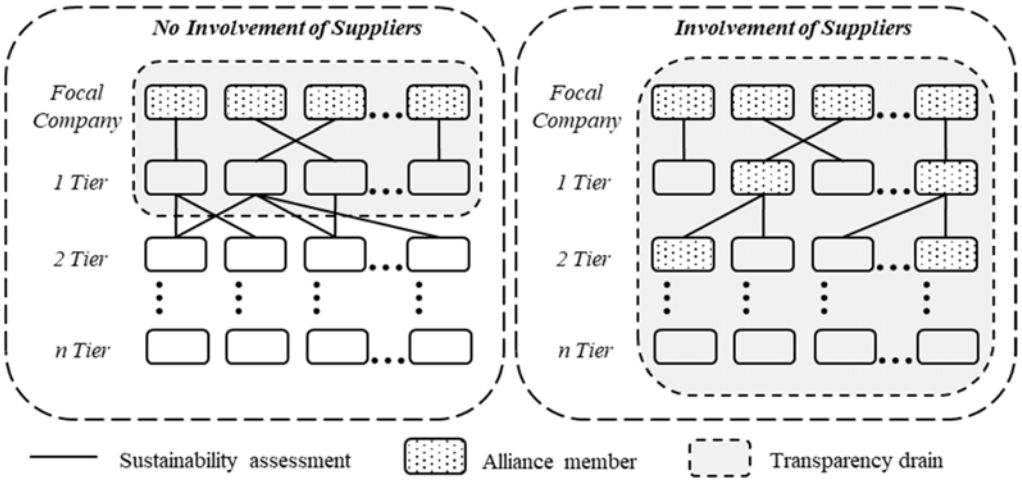


Figure 3. Schematic presentation of increased transparency through the active involvement of suppliers in ASSAs

Discussion

In order to derive propositions on the effects of ASSAs on the management of suppliers within MSCs, we connect our case study observations which were presented in the previous section with the rationales of AT.

Relating to AT, the more information a principal possesses about its agents' behavior, the more likely agents are engaged in behaviors that are consistent with the principals interests (Eisenhardt, 1989a). As observations show, the setting of ASSAs facilitates information gathering from suppliers as it increases suppliers' willingness to share sustainability-related information and thereby enriches focal firms' information on their MSC. However, the setting of Beta and Gamma provides additional incentives for suppliers to perform sustainability assessments due to their subsequent compulsory centrally controlled follow-up activities, which support suppliers in improving their sustainability performance. This is especially helpful for poorly performing suppliers. Thus, we posit the following two propositions:

Proposition 1a. The exchange of assessment results between the members of an ASSA increases suppliers' incentives to share sustainability-related information, fostering information-gathering mechanisms within MSCs.
Proposition 1b. The execution of compulsory centrally-controlled follow-up activities positively influences the willingness of non-compliant suppliers within MSCs to share sustainability-related information.

Deviations from the CSS of a focal firm, which are expressed as audit findings, can be traced back to the agency constructs adverse selection and moral hazard. To encounter these issues, collaboration activities with respective suppliers have to be executed, which cause additional agency costs and expenditures for the focal company. However, as observations reveal, the setting of Beta and Gamma fosters a more efficient collaboration between the focal company and their suppliers, as collaboration practices are organized and executed collaboratively among the members of the ASSAs. Moreover, Gamma's setting leads to additional efficiency gains, as its degree of collaborative actions among the members of the alliances regarding supplier collaboration is higher than Beta's. This observation is consistent with previous research by Oum, Park, Kim and Yu (2004), who found supporting evidence that the higher the level of cooperation in horizontal alliances, the greater the impact of alliances on a focal company's efficiency. This is why we postulate the following two propositions:

Proposition 2a. Collaboratively organized and executed supplier collaboration practices lead to efficiency gains for focal companies by reducing collaboration expenses while increasing the number of approached suppliers within MSCs.
Proposition 2b. The more supplier collaboration activities are managed jointly by the members of an ASSA, the higher the efficiency gains regarding supplier collaboration within MSCs for the focal company.

While the first two propositions relate to suppliers in MSCs in general, including first-tier suppliers and sub-suppliers, the following propositions solely focus on the management of the latter. Considering previous research and the rationales of the AT, the observation of the agent's behavior is hampered through the inclusion of sub-suppliers in supplier management practices (Fayezi et al., 2012), which exposes the principal to a heightened risk of opportunism by its agent. However, as observations revealed, the setting of ASSAs helps to mitigate barriers that prevent the detection of sub-suppliers' actions with respect to sustainability and thereby increases transparency in MSCs. More precisely, an ASSA is a useful tool to increase the leverage power on sub-suppliers, as purchasing volumes of single alliance members can be pooled, whereby negotiation power increases. This finding is consistent with previous research that illustrates that firms can improve their bargaining power by entering an alliance (Porter, 1980). Therefore, the barrier of a limited influence on sub-suppliers can be mitigated through the cooperation of firms within ASSAs. Moreover, through the membership structure of Alpha and Gamma, sustainability assessments of and collaboration with sub-suppliers can be executed through focal companies' suppliers which are also members of the ASSA and which have a contractual relationship with those suppliers. Consequently, the barrier of a lacking contractual relationship between the focal company and their lower-tier suppliers becomes also less predominant within ASSAs and, as a consequence, transparency in MSCs increases. Thus, we postulate:
Proposition 3a. The cooperation of firms within ASSAs positively affects the management of sub-suppliers within MSCs by improving focal companies' negotiation power over sub-suppliers.
Proposition 3b. Involving suppliers in ASSAs fosters the passing of CSS along MSCs and increases the transparency in MSCs on various tiers from a sustainability perspective.

Since the jointly executed supplier management practices of ASSAs facilitate the management of suppliers, improved suppliers' compliance with CSS could be observed through follow-up assessments by member companies of all three investigated ASSAs. This observation can be explained by considering the rationales of the AT. According to that, ASSAs, on the one hand, increase the amount of available information on the sustainability performance of suppliers within MSCs (see Proposition 1a, 1b, 3a, 3b). Therefore, the sustainability performance of a higher number of suppliers along various tiers of MSCs can be identified. Thus, the likelihood that those suppliers engage in behavior that is consistent with the focal firms' interests increases (Eisenhardt, 1989a). Moreover, collaborative supplier activities represent a further control mechanism to mitigate suppliers opportunistic behavior (Hajmohammad and Vachon, 2016), which can be executed more effectively through ASSAs (see Proposition 2a, 2b). Thus, suppliers sustainability capabilities, which were previously insufficient due to adverse selection, can be effectively improved, which fosters suppliers' compliance with CSS.

On the other hand, the setting of ASSAs aligns agent's preferences with those of the principal, which is another possibility for reducing risks in agency relationships (Eisenhardt, 1989a). This can be achieved through the provision of appropriate incentives for the agent, since the agent usually works towards maximizing rewards (Fleisher, 1991). As case study observations show, the setting of ASSAs improves the incentives for suppliers to comply with CSS of the buying companies. This is because the results of the sustainability assessments are potentially visible to all member companies of the ASSA and therefore a non-compliance has potentially higher negative effect on supplier's business. Thus, it can be concluded that cooperation of firms within ASSAs improves suppliers' compliance with CSS.

However, the configuration of Gamma's supplier management practices could be observed as the most effective at improving suppliers' compliance with CSS. This assumption is based on the fact that Gamma comprises all configuration options, which we refer to as having a positive effect on supplier management in our proposed propositions. Thus the conclusion can be drawn that Gamma's ASSA setting allows the most active management of suppliers within MSCs and therewith facilitates the greatest improvement of suppliers' compliance with CSS (Grimm et al., 2016). Thus, we posit:

Proposition 4a. The cooperation of firms within ASSAs improves suppliers' compliance with the focal company's CSS through the reduction of information asymmetry within MSCs and the alignment of suppliers' interests to those of the focal company.

Proposition 4b. An ASSA setting which simultaneously comprises compulsory centrally controlled follow-up activities, a high degree of jointly executed supplier collaboration practices and the active involvement of suppliers in ASSAs additionally promotes suppliers' compliance with CSS in MSCs.

Conclusion and implications

Triggered by the high complexity of managing an increasing number of suppliers with respect to sustainability, strategic alliances between competitors of the same industry are formed in the real-world context to meet stakeholders' growing sustainability expectations (Fayezi et al., 2012). The focus of our study lays specifically on ASSAs, which are primarily formed to shared audit reports of common suppliers to collaboratively manage shared suppliers. More precisely, three ASSAs from the railway, telecommunication and pharmaceutical industries were analyzed to gain insight on how companies collaborate within ASSAs to manage suppliers with respect to sustainability and to reveal the effects ASSAs have on the management of suppliers within MSCs. As no research thus far has investigated strategic alliances in the context of sustainable MSCM, our study findings are beneficial for both scholars and practitioners. In line with extant literature, by considering the rationales of AT, our study's findings confirm

that strategic alliances are an appropriate option for managing suppliers within MSCs with respect to sustainability (Tachizawa and Yew Wong, 2014). Moreover, our study not only confirms but complements extent literature by revealing how the sub-supplier approaching strategy *work with others* is implemented in practice and by providing insight on how sub-supplier specific barriers, such as missing contractual relationships (Choi and Hong, 2002) and limited negotiation power (Plambeck et al., 2012; Tachizawa and Yew Wong, 2014), are mitigated in a real-world context in order to improve suppliers' compliance with CSS. In this context, our study shows that members of ASSAs collaboratively execute supplier assessment and optionally supplier collaboration practices in order to prevent sustainability violations in MSCs.

Additionally, our study regards sustainable MSCM from an AT perspectives and thus applies AT to a new context. More precisely, it states that information asymmetry, which is caused by the typical agency constructs, adverse selection and moral hazard, poses a threat to suppliers' compliance with CSS. However, observations revealed that those agency problems can be controlled more efficiently within ASSAs since control mechanisms such as supplier assessment and supplier collaboration practices are executed collaboratively among the members of the respective alliances. Thus, suppliers' compliance with CSS is fostered through collaboration in ASSAs.

Even though ASSAs do in general improve suppliers' compliance with the focal company's corporate sustainability standards, the configuration of jointly executed supplier management activities as well as membership conditions vary between ASSAs and consequently influence the effects ASSAs have on the management of suppliers in MSCs. In this context, it was found that configurations such as compulsory centrally controlled follow-up activities, a high degree of jointly executed supplier collaboration practices and the involvement of suppliers in ASSAs have an additional positive effect on suppliers' compliance with CSS, as a more active management of suppliers within MSCs is fostered (Grimm et al., 2016).

From a managerial perspective, our research confirms that companies can benefit from a membership in an ASSA, as suppliers' compliance with CSS can be increased through collaborative supplier management. In addition, our research provides a guideline for practitioners on how to design ASSAs in order to most effectively manage suppliers in MSCs with respect to sustainability.

Although the application of a multiple case study design allowed an in-depth analysis of ASSAs in the context of MSCM for sustainability, it inherently possesses the difficulty of generalization. Thus, a large-scale study could be conducted to test the generalizability of our derived propositions. Additionally, other ASSAs could be investigated to reveal further configuration options and to study their effects on MSCM in order to provide further arrangement options to practitioners. Moreover, since our study exclusively explored effects of ASSAs on the focal companies MSCM, further studies could explore those effects from a suppliers' perspective. Although many positive effects of ASSAs on the management of suppliers within MSCs could be revealed, reasons why firms choose not to enter an ASSA are still unknown as our research focused exclusively on alliance members. Thus, the investigation of entry barriers for ASSAs could be a further interesting future research avenue. Furthermore, future studies could focus more specifically on the moral behavior of individuals, as moral decisions that influence a firm's compliance with CSS are not taken by a supplier as an entity, but they are taken by one or more individuals working for the supplying company. In the context of ASSAs, moral disengagement theory, which was introduced to supply chain management by Eriksson (2016), could be applied to investigate whether moral behavior of supplying companies' employees is influenced by a focal company's membership in an ASSA. Thus, another dimension could be added to this research topic.

In summary, our multiple embedded case study on ASSAs brings the present body of sustainable MSCM forward by identifying strategic alliances as a suitable means to manage both first-

tier and lower-tier suppliers with respect to sustainability. Thus, our present article functions as a starting point for further investigations exploring strategic alliances in the context of sustainable MSCM. Moreover, it provides helpful guidelines for supply chain professionals on how to design ASSAs to improve suppliers' compliance with CSS the most effectively. Thus, our research will undoubtedly support scholars and practitioners to solve MSCM problems, thereby not only reducing sustainability-related risks for focal companies but also fostering fair labor conditions as well as ecological sound practices in supply chains to ensure livable living conditions for present and future generations.

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Building an IoT vision

Report on the creation of a learning journey for Executive MBA students

Legenvre Hervé, PhD

European Institute of Purchasing Management

hlegenvre@eipm.org

Abstract:

The present article explores how at EIPM, we developed a learning experience for our Executive MBA students on how to create an IoT (Internet of Things) vision for a company. We present why we believe this was an important development in the current business context. We illustrate this thanks to an industry example on autonomous ships. We also describe the business ecosystem mapping methodology we used to create this learning experience. We then define how the learning experience was implemented and what we have learned from its implementation with two different MBA classes. We conclude with some reflection on the topic itself, on how we could approach education and research to reduce the time it takes between the emergence of new business challenges, to the development of valuable learning experiences that can help executives and professionals to address them.

Arthur C Clarke, the famous science fiction writer, believed that advanced technologies cannot be distinguished from magic. Today, you only need to watch the recent keynotes from leading high-tech firms to understand the relevance of his disconcerting observation. Gartner, the business intelligence company has taken this hindsight seriously and therefore issues every year a series of hype curves that map new technologies along a curve that includes a "peak of inflated expectations", a "disillusionment phase" and finally a "productivity plateau".

Today with the rise of the Internet of Things (IoT) together with the emerging technical and business systems (Robots, AI, Clouds, etc.) large scale disruptions, amazing societal benefits, fear of job losses and massive productivity gains are announced and debated every day. It will take a few years to understand the speed of diffusion and the true impacts of this transformation on industries. In this context of uncertainty, defining the right business strategies is an intricate task.

Connecting trillions of smart things, ranging from implants to industrial equipment; the Internet of Things merges the physical and online worlds. As machines are increasingly connected together, companies, governments, and consumers face opportunities and threats. The survival of some companies will be at risk, while others will be able to rethink their business models and to generate growth.

Today it is essential for Executives to build an IoT, or a digital vision where they identify opportunities and potential external collaboration they could benefit from. Looking at every single idea one by one, or discussing opportunities with all start-ups that have developed an interesting prototype cannot be the way forward. A vision for the future needs to be established so that promising directions can be further investigated, while others can be abandoned.

The present article outlines how, at EIPM, we have decided to address this challenge within our Executive MBA Programme. As part of the Innovation and Entrepreneurship module we have created a learning experience that focuses on this issue. We will look at how the Internet of Things (IoT) impacts business dynamics and we will see that it is essential to map the business ecosystem in a forward-looking mode to build an IoT vision. From this, we will briefly present The Ecosystem Mapping methodology we have developed over the past years. Hence, we will see how it is integrated within a learning experience where our Executive MBA students reinvent the Champagne value chain. We will conclude on the challenges associated with implementing such an approach within companies.

The IoT; Product-Service hybrid and the relevance of business ecosystems

The IoT has been defined by the International Telecommunication Union as "*the global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies*." The IoT changes products into product/service hybrids. As "Things" get connected, data is generated. The IoT can therefore be used to deliver digital services and to power new business models. A company like Michelin is well known for selling tyres. Today, sensors inside the tyre help its client reduce their fuel consumption and their operating costs. Michelin's innovation business model also enables its clients to pay for tyres on a per-kilometre basis.

Combining the physical with the virtual world requires assembling diverse capabilities. This calls for establishing collaborations that bring together companies and organisations with a different knowledge base. We often perceive the business world as a battle between old and new industries, as a race amid the east and the west, or as a competition between big corporations and start-ups. In reality, this world of competition is also a world of collaboration. This is a business ecosystem, where a diversity of

players "*coevolve their capabilities and roles and tend to align themselves with the directions set by one or more central companies*."(Moore, 1996)

This can be easily illustrated by recent announcements on autonomous ships at the marine division of Rolls Royce

Since 2014, Rolls-Royce Marine business performance has been negatively impacted by the consequence of the oil price collapse. The workforce has been cut by 25% over two years. However since 2015 new strategic initiatives have been communicated. Mikael Makinen, the head of Rolls-Royce Marine has announced: "Digitalisation will transform the shipping industry in the years ahead, and the time is now right to set out how we are going to make this happen," Rolls Royce focuses on autonomous ships. With limited investment capacity and a need to develop and access new skills and technology, the company has decided to look for partners. The following slide was presented at a conference in May 2016 by Oskar Levander, the Innovation VP of Rolls-Royce Marine. It clearly illustrates this last point.

Fig 1: Rolls-Royce Marine on Digital alliances

Indeed some alliances, partnerships and collaborations have been announced. In 2015, the Advanced Autonomous Waterborne Applications (AWAA) Initiative was launched. It is funded by Tekes, the Finnish Technology and Innovation Agency. It brings within a consortium different academic partners and existing maritime industry players such as DNV, Brighthouse, NAPA, Deltamarin, and Inmarsat. Most of this consortium work streams focus on technology, but some of them look beyond and address business and legal implications of autonomous ships. In 2016 and 2017 new partnerships on the client side were announced. Then in 2017, two new partnerships were announced including one with the European Space Agency (ESA) aimed at pursuing space activities to support autonomous shipping, and another with Google on AI to enhance the intelligent awareness systems. As we can notice collaboration is at the centre of the Rolls-Royce strategy to spearhead development for autonomous ships. Such partnerships include both academic and industry players. Furthermore, industry players go beyond the existing industry boundaries to include ESA and Google. The case of the Rolls-Royce autonomous ship strategy raises some interesting questions: How do you develop a vision and a strategic roadmap for such a transformation? How do you identify partners? How to effectively implement a strategy in such a context?

Thinking in ecosystems: A methodology

We see that with the rise of IoT and the ongoing series of digital transformations, Executives need to address some important questions. Consequently, their answers will have a fundamental impact on the future of their company. These questions include: *"Who will be our most important external innovation partners in the next X years?" and "How will we work effectively with them?"* Answering the first question requires looking well beyond what they see as their existing strengths and weaknesses to spot forthcoming opportunities and threats. It can only be achieved by scanning what is taking place within and beyond the industry boundaries; by finding out where are the outposts of future transformation of the industry architecture (startups, new suppliers, new clients, and new players from other industries that could help change how value is created and captured). A classic Porter five forces analysis will take you in the right direction, but you will need to look at the peripheral forces and to consider future developments. You need to understand what changes happening today could, in the future, generate new business models and bring substitutes to their existing offers.

Thinking in ecosystems does not need comprehensive and lengthy analysis. It requires people to change their perspectives, to spot opportunities, to experiment rapidly so new hypotheses can be tested and new knowledge can be gained before business model innovations can be achieved

At EIPM we have developed a methodology that can contribute to this. It is based on Six steps, they are as follows:

1-***Define the scope of application***: this can be a business unit, a product group, a value chain or some key business activities. Within that scope, current business goals, value drivers and main challenges should be identified.

2- ***Identify the trends that will bring changes in the future***. This should help participants extract themselves from their day to day environment, so they can to develop their sensitivity to weak signals and emerging forces.

3- ***Identify future Ecosystem players***. Finding out who you work with today is relatively easy. It is more difficult to identify who could be important to work with tomorrow. Building on the analysis of the trends, you can identify some companies or organizations that can be future ecosystem players.

4- ***Map the ecosystem***. We will show some examples later in the text. Here, you can position next to each other four types of players: (1) the customers, (2) current value chain players, (3) potential or rising members of the value chain, (4) influencers (mainly governmental bodies and Non-Governmental Organizations). This is a visual representation that will help everyone have some key discussions.

5-***Understand the dynamics within the Ecosystem***. No one can predict the future but a few simple questions can help. They include: Today who competes with whom… on what? Who collaborates with whom… on what? Tomorrow who could compete with whom… on what? Who could collaborate with whom on what? These are simple questions but they help to lift today's blinders and explore what might happen tomorrow.

6-***Define your ecosystem strategy***. Here you can simply agree on the following three priorities: What you should monitor in the future? Who you should start to talk with in the near future? And who you should try to partner with in the near future? This is a plan that could evolve over time but it will give a sense of direction to the transformation you will undertake

To learn more about this methodology, you can use an article published in the European Business Review (Legenvre; 2016)

Building an IoT vision: Creating a learning experience For EIPM Exec MBA Participants.

Over the past years The Executive MBA has been strengthened to reflect the business environment

- The Business strategy course has integrated a specific module on platforms
- The Strategic Information System Module has evolved to reflect the challenge associated with a digital transformation
- Special additions have been made to some specific courses such as Blockchain and Smart Contract that are now covered in the supply chain module and discussed more in depth in our 2017 master Class
- Integration of Design thinking / Lean Startup and Business Ecosystem analysis in the course on Innovation and Entrepreneurship since 2015

In 2017, we created a more integrated learning experience that would help our Executive MBA students to build a compelling IoT vision for a business. Following our research activities on the impact of IoT we had realized the importance of providing our participants with something practical and concrete they could use in their business environment.

We established the following objectives for this learning experience

- Help participants understand the challenges and opportunities associated with the IoT
- Equip participants with tools to build a Digital / IoT vision for their business
- Help participants see the big picture so they can avoid a sub optimisation trap
- Think in Ecosystems / Develop a portfolio of innovation collaborations

As we developed the learning experience, we added the following learning goals

- Discover the power of Minimum Viable Products
- Explore challenges associated to innovation with external players

For this learning experience we decided to focus on the Champagne industry. This is an appealing and interesting industry for participants. They can rapidly discover it as there are limited technical complexities that need to be understood. But most importantly, it offers a wide diversity of contexts as it touches on farming activities, production activities, distribution and supply chain, retail and customer experience. So instead of focusing on what IOT means for agriculture or retail, we have here a broad value chain that can combine diverse perspectives.

Prior to the learning experience, we had two other sessions that provided some useful inputs to it:

- A session on trends where we described what the Internet of things is. We provided an overview of the IoT, some examples of application and some analyses of how it changes industry architectures. This provided a chance to discuss what opportunities Buyers could seize in this context.
- A session on Design thinking, where participants were introduced to two concepts that are important for the learning experience: Pain point as a source of innovation ideas and Minimum Viable Products as a way of designing and presenting an innovation.

The learning experience started right after lunch on the third day of the course and participants were required to present the outcomes of their work at 12.00 the day after. They therefore had about 24 hours to work on it. The groups were provided with the following inputs:

- ***The Goal of the workshop***: help a Company active in the Champagne business to make the most of the Internet of things by creating a compelling vision
- ***The Champagne value chain*** was presented to the participants. It was structured around the following six steps:

Fig 2: The champagne value chain

We used videos to introduce the industry context:

- https://www.youtube.com/watch?v=HRxPWRZgicM
- https://www.youtube.com/watch?v=wGffdxnM0_U

Participants were split into small groups. Each group had to focus on two steps of the value chain. They were free to choose. Some clearly had more interest on specific steps of the value chain.

Each group was briefed orally on the business goals and pain point challenges associated with the steps of the value chain they had chosen. The briefs were developed using industry reports found in the ProQuest database and thanks to an interview conducted with the CPO of an existing industry player. We decided that readings would not be provided and that presenting it orally was the best way forward. We wanted them to focus on the IoT related reading, and not on the industry information

Each group had to go through the following steps.

1. Define the scope of their work. Here they had to summarise the business goals and the pain points encountered during the stages they were working on.
2. Perform a full Ecosystem analysis. For this they were provided with an Ecosystem toolbox so they could go through each step of the Ecosystem's methodology swiftly.
3. Propose one Minimum Viable Product using one picture or one slide. The key idea here, was to confront them with the challenge to pitch one idea in a compelling way
4. Define the IoT solutions you intend to implement and the expected benefits associated with these.
5. Prepare a Four slide presentation. We will see an example underneath

The overall process was summarised using the following diagram

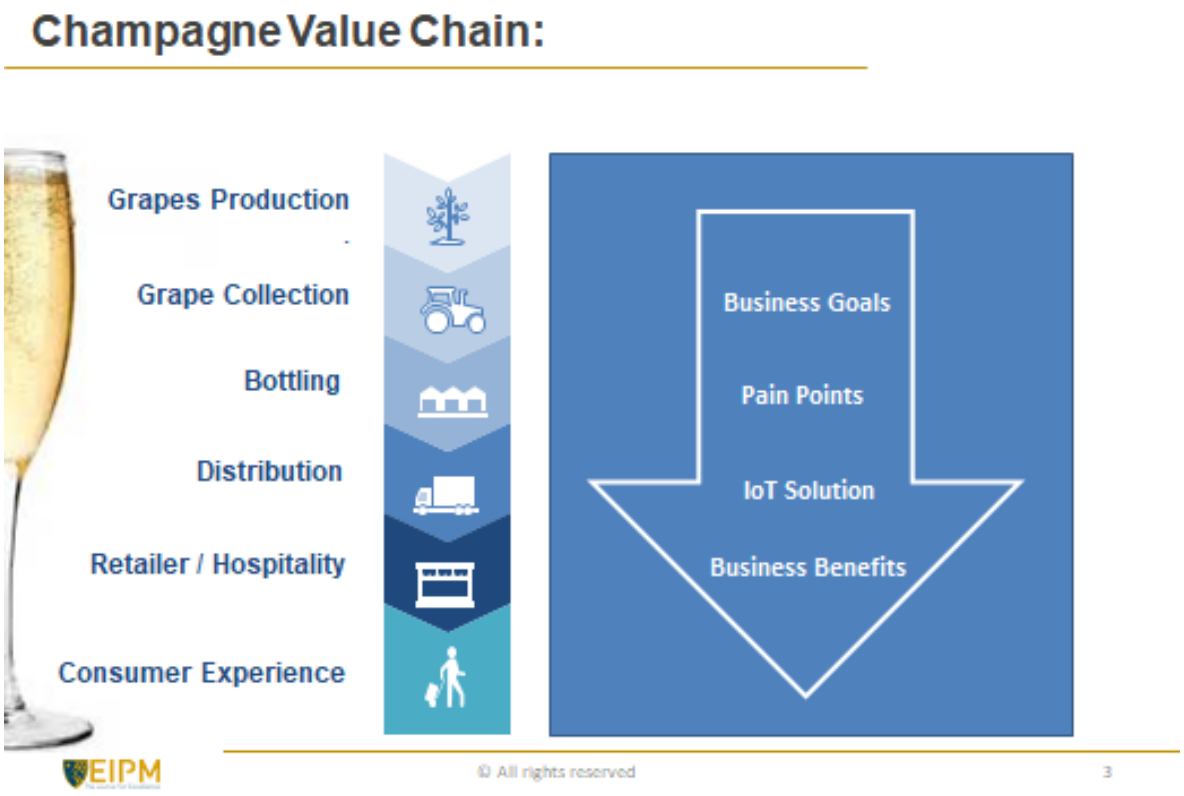

Fig 3: Summary of work to be completed

Each group was provided with a wealth of information on start-ups and innovation that could impact the steps of the value chain they were looking at. The idea was to create an information overload, and to confront them with the reality of being overwhelmed with opportunities.

We had discussed the opportunity of creating a more condensed pack of information with a pre-selection of ideas and innovation. However, we wanted to be closer to the real world and we decided to provide extensive data.

To do this we used different types of resources. Some aimed at providing an overview of many solutions with limited depth. Participants were free to find more information on the concept they could be interested in.

Here we used resources from CB insights including:

- The Ag Tech Market Map: 100+ Startups Powering The Future Of Farming And Agribusiness https://www.cbinsights.com/research/agriculture-tech-market-map-company-list/
- Stocked Up: 150+ Companies Attacking The Supply Chain & Logistics Space https://www.cbinsights.com/research/supply-chain-logistics-tech-infographic/
- The Store Of The Future: 150+ Startups Transforming Brick-And-Mortar Retail In One Infographic https://www.cbinsights.com/research/retail-store-tech-startups-2016/

These are excellent because they are quite synthetic and provide a wealth of ideas.

More specific and detailed articles were also provided. They were meant to provide examples of innovation with more depth, but also to question the value of these innovations, this included for instance:

- IoT now helping make smart wine? https://readwrite.com/2016/04/04/iot-makes-smart-wine-agriculture-if4/
- Kuvée: The internet-enabled smart wine bottle no-one asked for http://www.independent.co.uk/life-style/gadgets-and-tech/news/kuvee-smart-wine-bottle-screen-internet-indiegogo-a6958751.html

These helped to provide descriptions of more tangible applications.

All groups worked extensively on their topic. Some worked late at night, others started very early in the morning. They received support throughout, especially on the use of the Ecosystem methodology.

They all presented their outcomes and an overall presentation was aggregated and redistributed to all of them. One copy was also sent to the CPO of the Champagne Company. His feedback was the following:

"Thank you for the document. This outcome is interesting and I would welcome the opportunity to hear more about that investigation work."

It was circulated back to the participants who appreciated it.

Building an IoT vision for the Champagne Industry: The outcome of this learning journey

The quality of the results from each group was very consistent. All of them developed a well-documented ecosystem and described a four or five slide IoT vision. The best way to describe these outcomes is to show what one of groups came up with:

They summarised for each step the business goals and the pain-points. For the distribution step, they presented a few bullet points that were explained more in depth orally.

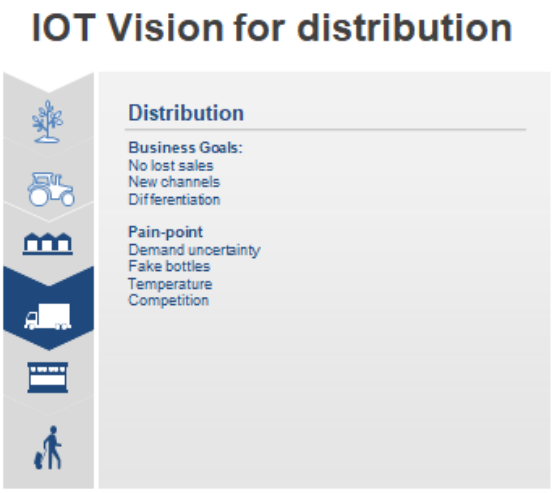

Fig 4: Example of outcome:

All Groups performed an in-depth ecosystem analysis and created a map of the ecosystem for the steps they covered. This was shared in their final presentation. All groups had identified six to twelve rising and new players. This was a good outcome. The next figure presents the outcome of the group that addressed distribution.

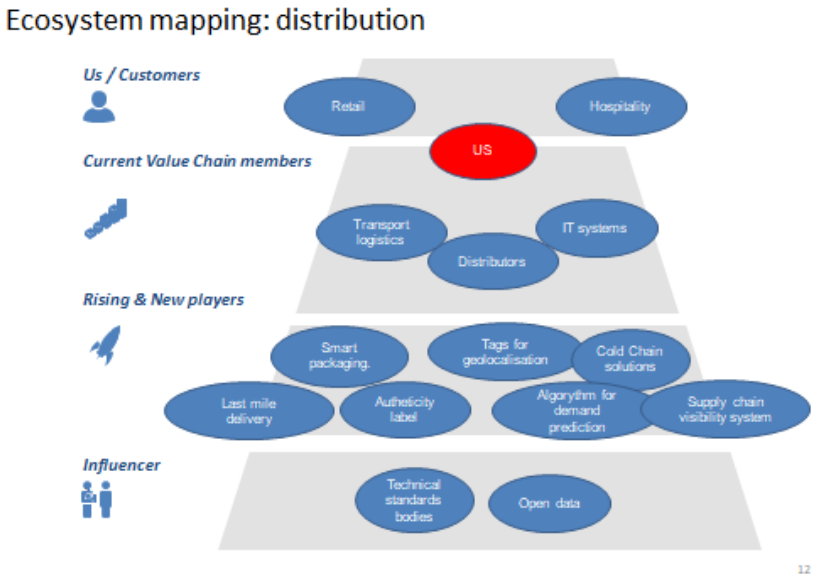

Fig 5: Ecosystem map for Champagne distribution

The third expectation for the final presentation was to present one Minimum Viable Product. The idea was to encourage them to pick one idea from the few proposed and to pitch it to the group. The next figure presents the creative outcome of the group that addressed distribution.

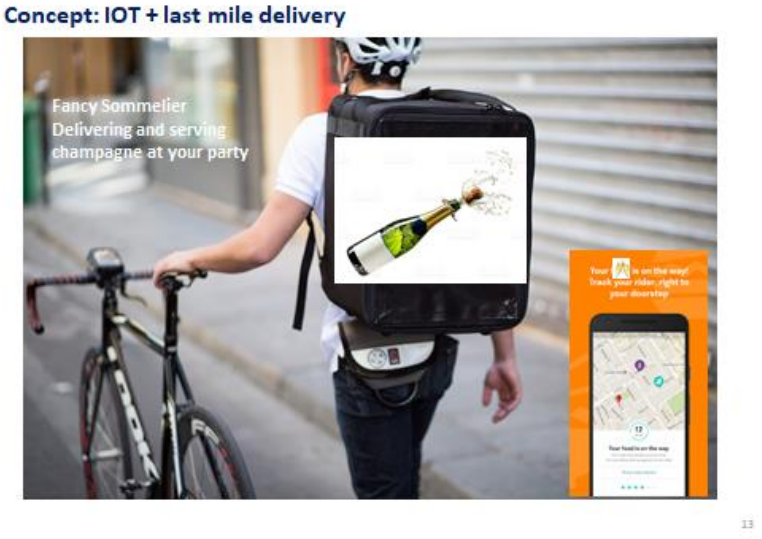

Fig 6: MVP for Champagne distribution

Finally, each group had to conclude the exercise with a helicopter view of the IoT solutions and the expected benefits. The next figure presents the outcome of the group that addressed distribution.

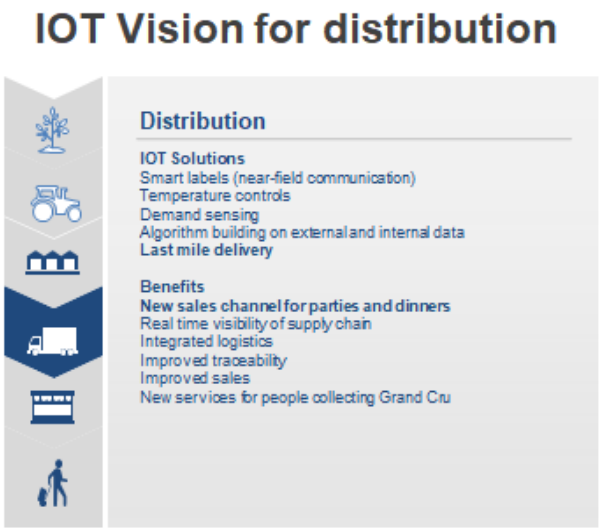

Fig 7: final slide on IoT vision for Champagne distribution

Education outcomes and lessons learned

This module was delivered in Europe during the summer of 2017 and in China in November 2017. Feedback was gathered from the participants both as a group and individually. The main learnings were the following:

- This significantly raised the participants' awareness of the impacts of the Internet of Things on their industry. We had overestimated their awareness. They associated IoT with an idea or two, but they did not suspect that it could impact an industry throughout its entire scope. This did not hamper the learning. It was an additional benefit
- Participants enjoyed the case. In Europe, participants liked a lot the choice of the Champagne industry that offered a diversity of perspectives. In China, we had a little surprise. Chinese tend to prefer warm drinks to cold drinks. This made it hard for them to start the exercise, especially on the distribution and retail side. They found it challenging to find ideas on how to promote Champagne within China. Nonetheless, they ended up with some interesting ideas to connect this promotion with wedding banquets
- Some participants expressed the view that there was a lot of documentation to read. However, they also said if the group was well organized, it was not a problem to handle this. In fact they enjoyed having access to so many startup examples and many of them subscribed to the CbInsights newsletter afterward.
- Relative to mapping ecosystem. They had no difficulties in applying the methodology thanks to the toolbox they had received. They suggested to have a more structured individual debrief and feedback of their use of the toolbox, instead of having a generic feedback with the full group.

All Participants found the exercise interesting and of value. They said they would like to have the opportunity to do something like this within their company. Nevertheless, some of them found it difficult and challenging to implement. Some comments included:

- "We don't have the necessary maturity in my company to do something like this"
- "It would be difficult to involve all departments in doing this"
- "We are still expected to reduce the number of suppliers and here we go in the opposite direction".
- "It forces us to look at what we don't usually look at. It is good but this is hard"
- "Who has time for this?"

These were not questioning the methodology and the tools used. This was all about questioning the ability of their company to be ambidextrous enough to go in this direction.

This overall experience was very positive, and we will continue to pursue it. We intend to fine tune and enrich it. The main improvement ideas relate to the documentation provided. We will keep the same logic, but we will limit the number of articles that have more depth. Also we intend to associate for the session in Europe someone from this industry to the workshop. For China, We are considering taking a more local case, using for instance a drink based on herbal medicine. This would be very much welcomed by the Chinese participants.

Conclusions

Recently the former CPO of an FMCG company said in a CPO forum "*The question is not if the IoT will impact our business. It is about how the IoT will Impact us and how it will change the supply base and market dynamics within our segments. We need some frameworks to help us with this."* The present paper outlines a learning experience we created to address this expectation. In a fast-changing world, we cannot adopt a linear approach: starting from research, developing case studies and then creating teaching cases on a specific topic. We need to work closer with companies that are at the forefront of the merging changes, we need to understand their expectations and how we can adapt our frameworks to help them progress. We need to experiment, so we can provide an engaging learning experience to our students and participants. Such learning experiences might also provide opportunities to develop and apply new research methodology, so we can reduce the time gap between what takes place in supply chains, and the development of research outcomes.

We have reported in the present paper on the development of a learning journey that can help our students and course attendees develop IoT or digital vision. What have we learned from this?

On the topic itself, thinking and working in ecosystems requires executives to question their current practices:

- They need to challenge their way of thinking by looking at the trends that will define success tomorrow. This is not about being creative, but this requires combining lateral and long-term thinking. It can be nice and easy to do this once… but the challenge is to persevere and to become more ambidextrous as an organization.
- We need to prepare executives and professionals to welcome the idea that external collaborations become more essential to their company's success. This can be a challenge for

many people. It is also a challenge for buyers. When they see innovation, they see risks not opportunities. We need a cultural transformation here.

Also In terms of education and to some extend research, we should consider some new ways of thinking:

- We need to anticipate changes in the business world, so we can better equip our students with the right frameworks and ways of thinking
- We need to experiment and develop progressively new learning experiences in a structured and systematic way
- Beyond using teaching cases or well-established simulations, we need to think about the advantage and inconvenience of using real materials and creating life like situations. This needs to be fulfilled without sacrificing on simplicity and the quality of learning. This is an interesting challenge
- Creating new learning experiences can help generate knowledge and help us answer some emerging research questions. This is indeed an opportunity we could explore.

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Combining Distant Capabilities: A Research Framework

Hervé Legenvre
European Institute for Purchasing Management
hlegenvre@eipm.org

Jury Gualandris
Ivey Business School
jgualandris@ivey.ca

Davide Luzzini
EADA Business School
dluzzini@eada.edu

Abstract
This paper defines what we mean by combining distant capabilities. We combine different stream of literature to show that innovation result from the combination of an assortment of capabilities characterized by certain degrees of geographic, knowledge, social, institutional and organizational distance amongst them. We focus on knowledge and organizational distance as the main characteristics of our research framework on how to combine distant capabilities. We then develop a model where cognitive fluidity and cognitive rigidity impact on how inter-organizational and inter-personal linkages evolve over time. This offers practical advantages to understand how capabilities are combined, integrated and transformed into innovation and economic value.
Keyword: distance innovation, network

This article develops a research framework on how distant capabilities are combined to generate innovation and economic value. We first provide some definitions and suggest that the micro-foundations of how distant capabilities are combined together still need to be developed. We describe our understanding of how inter-organizational and inter-personal networks combine distant capabilities over time. While new organizations and individuals come in, others disappear; some become more central to the innovation effort while others take a more peripheral role. In such a process, individuals are connected together through inter-organizational and inter-personal linkages. Their assumptions and belief evolve as ill-defined problems are framed and solved. Their actions and decisions modify existing linkages, eliminate some of the previous ones and create new ones. Innovation occurs as distant capabilities get combined thanks to cognitive process that frame inter-organizational and inter-personal linkages. After developing our research framework we acknowledge that combining distant capabilities could be studied through a diversity of theoretical lenses. We therefore develop some complementary hypothesis outlining influences that could impact on the evolution of the inter-organizational and inter-personal linkages that combine distant capabilities.

Introduction: distant capabilities

In October 2017, Rolls Royce and Google announced a partnership aimed at using machine learning to create autonomous ships. Cameras, sensors and scanners located on Rolls Royce

vessels will provide data that will be analyzed thanks to Google's Cloud Machine Learning Engine. This will allow tracking objects encountered by ships so hazards can be anticipated. In the aerospace industry, Airbus looked into existing options for geo-localization and asset tracking services and they selected early 2017 a Belgium start-up named SENSOLUS as partner. Their solution offers Airbus the ability to track in real time recyclable packaging that contain plane parts and spare parts across the company and its suppliers. The solution is energy-efficient, easy to install, reliable and scalable. It builds on another start-up, SIGFOX that offers connectivity through low-power wide-area network. Such collaborations amongst unfamiliar players are not solely the result of the existing digital transformations; other concerns such as sustainability can motivate their developent. For instance, since 2010, in Great Britain, Network Rail has partnered with an NGO to reduce suicide on the railways.

As firms realize their organization do not control all capabilities required to excel, strategic collaborations amongst players with heterogeneous sets of resources and capabilities are becoming more common and visible. Firms need to innovate by exploring external resources and capabilities they lack (Chesbrough & Crowther, 2006; Pisano & Verganti, 2008; Gualandris, Legenvre & Kalchschmidt, 2017). This takes us back the insight of Adam Smith (1776), who looked beyond the division of labor within factories and associated innovation with the combination of distant capabilities: "*All the improvements in machinery, however, have by no means been the inventions of those who had occasion to use the machines. Many improvements have been made by the ingenuity of the makers of the machines, when to make them became the business of a peculiar trade; and some by that of those who are called philosophers or men of speculation, whose trade it is not to do anything, but to observe everything; and who, upon that account, are often capable of combining together the powers of the most distant and dissimilar objects*". This division of labor in innovation activities reflects for instance how the British textile industry during the late 18th century harnessed the power of the steam engine and other technical and social changes that were diffusing across Europe. Today as many value chains are highly fragmented; as firms compete against new entries or enter new strategic arenas, as a new technologies and business models are changing the rules of competition, firms need to combine distant capabilities to deliver superior performance and innovate in this rapidly changing world.

This motivated us to identify important gaps in our theoretical and empirical understanding of how innovation occurs through the combination of distant capabilities and to suggest future research avenues. The relevance of this approach has been outlined by different school of thoughts; however we realized that the micro-foundations of how distant capabilities are combined together still need to be developed. We therefore propose in the present paper a research framework to study how innovation networks combine distant capabilities. We see this attempt as a contribution to the better understand how ecologies of diverse organizations, institutions and agents produce product and service innovation (Dougherty & Dunne, 2011). We look beyond single firm perspective to investigate how two, three or more organizations combine different capabilities in order to innovate. In our approach, organizations own specific capabilities that are combined thanks to inter-organizational and inter-personal networks. The actions and decisions of interdependent individuals change the structure of innovations networks at individual and organizational level. This allows to combine distant capabilities and to generate new streams of innovation.

This paper is structured as follows. It first frames the concept of distant capabilities by building on three research streams: the resource based view of the firm, the proximity school and the study of local vs distant innovation search process. This will allow us to better define

what we mean by distant capabilities and to highlight existing research gaps. From this, in a second part we further explore the micro-foundation of how distant capabilities are combined by looking at how inter-organizational and interpersonal linkages evolve over time. As linkages evolve problems that are due to the distance between the capabilities are identified framed and solved. This impacts the beliefs of individuals who through their actions and decisions change existing linkages, eliminate some and create new ones. As we propose a composite concept that combines different disciplines and multiple levels of analysis, our research framework will benefit from the contribution of different theoretical viewpoints. Without trying to be exhaustive, we then suggest how different theoretical lenses offer hypothesis on some of the critical influences that could affect the evolution of inter-organizational and interpersonal linkages. This will lead us to reflect on our work and on describing future research avenues.

Combining distant capabilities: theoretical foundations

Defining what we mean by distant capabilities starts with looking at the meaning of capabilities. In the 1990's, management scholars increasingly described firms as a bundle of "resources and capabilities" (Barney et al. 2001). Capabilities have been defined as a firm's capacity to deploy resources thanks to information-based, tangible or intangible processes (Amit & Schoemaker, 1993). Capabilities span a continuum from general purpose capabilities that can be applied to a broad range of use used to application specific capabilities with limited range of use (Pisano, 2015). A subset of capabilities with specific characteristics could provide the firm that owned or controlled them a sustainable competitive advantage. The extended resource-based view (Eisenhardt & Schoonhover, 1996; Lavie, 2006) and the more recent literature on dynamic capabilities (Teece, 2007) shows that firms innovate through collaborations with a variety of actors in the firm's ecosystem – i.e. "the community of organizations, institutions, and individuals that impact the enterprise and the enterprise's customers and suppliers" (Teece 2007, p. 1325). Concepts such as absorptive capacity (Diana Van Aduard De Macedo Soares, T et al.) or ambidexterity (Lucena & Roper, 2016) have been refined over time to describe how firms come in contact with distant actors, markets, and technologies compared to their knowledge domain. The theoretical foundations of dynamic capabilities specify the stages of sensing, seizing and reconfiguring the firm's ecosystem as a key passage to generate competitive advantage. However, extant studies only partially tap into the challenges of combining distant resources and capabilities. The strategic management literature on complementary assets (Helfat 1997), mostly focuses on the outcomes of complementarities rather than addressing how such complementarities are merged to build value.

Another group of scholars have shown that different forms of proximity matter for innovation (Balland & al., 2014). The proximity school allows us to better define what we mean by "distant" when looking at distant capabilities. Beyond geographical proximity four other forms of proximity: cognitive, social, institutional and organizational proximity have been studied over 20 years. Cognitive distance refers to the extent to which actors hold different knowledge base. In our framework presented underneath we will prefer using the word knowledge as we reserve the word cognition for another purpose. Organizational distance refers to the membership of actors to different organizational entity. Social distance refers to a lack of prior personal relationships amongst actors. Institutional distance refers to the heterogeneity in terms of norm and incentives that characterized the actors involved in joint innovation activities. As proximity reduces cost and facilitates communication it facilitates collaborative innovation activities. In a study of automotive and pharmaceutical firms a U-

shaped relationship between cognitive distance and innovation performance has been identified. This led to the idea that an optimal distance could exist (Noteboom, 2007). Recent research findings have highlighted the existence of the proximity paradox. Proximity enables the formation of knowledge networks but does not necessarily lead to superior innovation performance (Boschma & Frenken, 2010; Broekel and Boschma, 2013; Cassi & Plunket, 2013). Future studies are expected to investigate how knowledge networks and proximity co-evolve over time (Balland et al., 2014). If on one hand proximity facilitates the formation of ties in networks; on the other hand as innovation networks evolve they create proximity. The proximity school helps us define the meaning of "distant" and suggest us to consider diverse distance factors. It also points us in the direction of studying the factors that influence the evolution of innovation networks to develop our approach.

We will now look at the literature that investigated the relevance of local and distant innovation search. This will provide us with the foundation to define "distant capabilities". As we will see that the impact of local and distant search on innovation outcomes has been extensively studied we will also realize that we still need to explore the micro-foundation of how distant capabilities are combined. Innovation results from the combination of different bodies of knowledge (Nelson and Winter, 1984; Kogut & Zander, 1992). Consequently the search for new source of knowledge has been regarded as an essential dimension of innovation. The distinction between local vs distant search has existed since the seminal work of March and Simon (1958) Local search is defined as a search for solution in the neighborhood of the firm current knowledge base (Rosenkopf & Nektar; 2001). These searches can be characterized by different level of depth and breadth. It was repeatedly emphasized that organizations tend to focus on local search (Dosi 1982, Rosenkopf & Nektar; 2001). New search are constrained by past ones and firms display myopic behaviors. An over-focus on local search can be harmful for a firm (March 1991; Rosenkopf & Nektar; 2001). Recently, the complementarity between local and distant search has been emphasized. Kaplan and Vakili (2014) demonstrated that combining distant and local search allows the transformation of novel ideas into economically valuable ones. They suggested that further research needs to be undertaken in order to understand how conflicting practices can lead to effective outcomes by that an inter-organizational perspective. What they describe as a "conflicting creative process" needs still need to be investigated.

The meaning of distant capabilities

The three research streams presented above show that the major research gap we need to address lies in the absence of micro-foundations on how distant capabilities are combined to generate innovation. They nevertheless help us define what we mean by distant capabilities. In our framework, innovation occurs through the combination of diverse general purpose and application specific capabilities. The distance between the capabilities mobilized can be characterized by the geographic knowledge, social, institutional and organizational proximity they have together.

For the sake of clarity, in the present article, our definition of distant capabilities focuses on two specific factors: Knowledge: to what extent the capabilities combined together rely on heterogeneous knowledge base and Organization: to what extent intra or inter-organizational linkages with familiar or unfamiliar organizations occur. This is consistent with Rosenkopf & Nektar (2001) who have developed a typology of exploration behaviors where organizations span both organizational and technological boundaries when performing distant search. The remaining proximity factors will be integrated within our research framework.

The following graph illustrates our definition of distant capabilities. It can be applied to the combination of two or more capabilities with one of them acting as the reference in the bottom left quadrant.

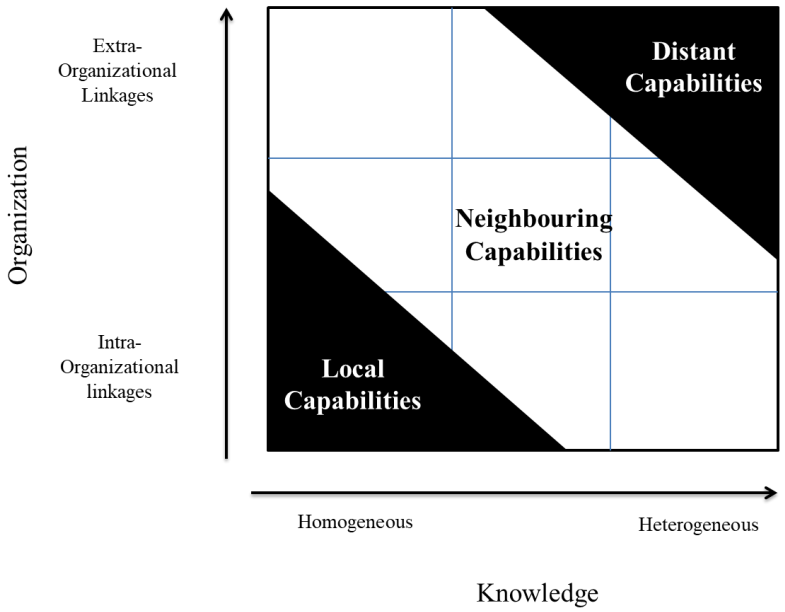

Fig 1: Combining distant capabilities

If an organization intends to deepen an existing capability, it can use intra-organizational linkages. This can be done thanks to a cross functional team that brings different department together or by a collaboration across different units across the business. Rolls-Royce who wanted to build on its experience in data-led services acquired for instance with aircraft engines has launched a Data Labs to bring together expertise from across the business and support further data innovation. If the aircraft engine business of Rolls-Royce was working with this lab we would typically be on the bottom left corner of the matrix

Deepening an existing capability can also rely on extra-organizational linkages. A firm can work with an unfamiliar electronic design house to expand its electronic design capabilities. In such a case we would be in the top left quadrant of the matrix where the knowledge is homogeneous but where inter-organizational linkages with unfamiliar organization are established.

Broadening a portfolio of capabilities can be achieved through intra organizational linkages. Continuing with the example of The Rolls-Royce data lab, A Rolls-Royce Business Unit with no experience with data-led services can leverage the Central Data lab to access new capabilities. From this it can combine its own capabilities with the central Data lab know how in order to develop innovative business models for its own market. Here we are in the Bottom right quadrant of the matrix.

In 2017 Rolls-Royce and Tata Consultancy Services (TCS) decided to expand their long-standing partnership in order to exploit future data innovation opportunities. The focus of this collaboration is to leverage the TCS IoT platform within Rolls-Royce activities. We are here in the central quadrant of the matrix we describe this as combining neighboring capabilities.

Indeed, this initiative focuses a neighboring knowledge field: the IoT platform thanks to extra-organizational linkages an industry neighbor: TCS.

Finally, we can look at the collaborations between Rolls-Royce Marine Business with Google on machine learning. This was presented as a first of its kind agreement in the marine business and the aim was to develop intelligent awareness systems for future autonomous ships. This can be positioned on the top right corner of the quadrant, as an attempt to combine distant capabilities.

We have now defined our approach. We have described the concept of distant capabilities by focusing on two proximity factors: knowledge and organization. Other factors will be addressed in our research framework that can be now established

The distant capability research framework

We can now move to the development of our research framework. According to Taylor and Hefat (2009) "*innovating firms need to go beyond simple access to complementary assets to successfully navigate technological transitions. Companies must create and manage organizational linkages involving the new core technology, new complementary assets, and potentially valuable pre-existing complementary assets. Otherwise, without the organizational ambidexterity required to link the new with the old, the end result may be a technological advance that fails to meet market needs."* These authors outline the importance of linkages to manage technological transitions. If they acknowledge the need for external linkages, they decided to focus on linkages within an organization. In our approach, we will adopt two different levels of analysis. The first one is at organizational level and it will allow us to consider inter-organizational linkages. The second one is at the individual level and it will allow us to look at interpersonal linkages that take place within and across organizations. Furthermore Taylor and Hefat (2009) identify four critical influences: economic, structural, social, and cognitive on managerial linking activities; in our framework, we will initially focus on how cognitive processes influence linking activities, We will consider how the evolution of the assumptions and belief held by the individuals involved in combining distant capabilities impact on the evolution of the inter-organizational and inter-personal linkages.

Initially, some individuals decide to tie together different and sometime distant sources of knowledge and expertise with the aim to create innovation and generate economic value. Individuals are then connected together to frame and solve ill-defined problems. Such problems can be exacerbated by the distance between the capabilities (or eased by their proximity). When experts from a tennis racket manufacturer meet with specialists of artificial intelligence with the aim to create a connected tennis racket that will give feedback to the user, they might not have a common language that will help them to make progress. As problems are framed and solved the beliefs of individuals involved throughout the linkages evolve and through their through their actions and decisions they change the boundaries of the network. New inter-organizational and inter-personal linkages are created while others are eliminated. This leads to another set of problem framing and problem solving activities that impact on the belief of individuals and ultimately on the linkages. Individual involved in this process learn how to manage and sometime how to abolish the distance between the

capabilities. This is achieved through the communication and coordination activities that underpin the problem-solving ones. The following diagram describes our research framework.

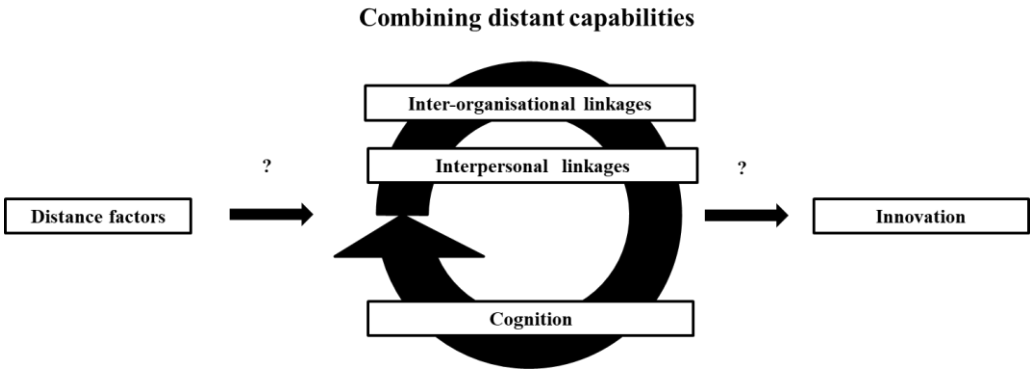

Fig 2 Research framework: Combining Distant Capabilities

The distance factors taken into account within our research framework are described in the table below. This builds on Boschma (2005) and on Balland & al (2014)

Knowledge Proximity	Knowledge proximity means that individuals share the same knowledge base and expertise Knowledge proximity allows individuals to absorb and use new information rapidly. Knowledge distance hinders effective communication and learning. Excessive knowledge proximity can prevent individuals from seeing opportunities while knowledge distance can favor creativity and novelty As distant capabilities are combined knowledge overlaps increase amongst the individuals involved.
Organizational Proximity	Organizational proximity is characterized by pre-existing linkages within and across organizations. This can be described as strong ties such as hierarchies, as loosely coupled networks or weak ties such as buyer-supplier relationships or networks or simply as no ties. While organizational proximity allows controlling intellectual Property rights and to reduce the risks of opportunistic behavior; organizational distance prevents myopia and offers more flexibility to access a diversity of resources. As distant capabilities are combined, organizational distance diminishes at least temporarily. Weak ties emerge between organizations that had no common experience before and some firms might acquire a partner and create stronger ties.
Social proximity	Social proximity is characterized by the the existence of trust due to friendship, kinship and experience.

	While social proximity is expected to favor the exchange of tacit knowledge and the commitment of individuals over time; social Distance can prevent actors from being locked in long term relationships and commitments so they can seize new opportunities more effectively. As distant capabilities are combined, social distance reduces; individuals go through common experiences and build personal relationships.
Geographic Proximity	Geographic proximity is defined by the spatial or physical distance between individuals. Geographic proximity allows to access knowledge externalities. It reduces the costs associated with face to faces interactions and the time required for taking decisions. Geographic Distance can however prevent some of the individuals from being overwhelmed by interactions. A startup with limited resources can benefit from geographic proximity in order to create enduring linkages. It can also be protected by the distance from being involved in an overwhelming number of interactions. As distant capabilities are combined, Geographic distance can be temporarily or permanently reduced as individuals can be temporarily co-located or as some organizations can re-locate activities
Institutional proximity	Institutional proximity consist of common habits, routines, established practices, rules, or laws that regulate relationships and interactions between individuals and groups

We now need to further describe the managerial influence we have selected: managerial cognition. As described above search are constrained by past ones and myopic behaviors are common in exploration (March 1991; Rosenkopf & Nektar; 2001). This outlines some inability to recognize opportunities or difficulties and to act upon them. This lead us to focus on one of the critical managerial influence on linking activities identified by Taylor and Hefat (2009): Managerial Cognition. This choice is in line with Gavetti (2005) who has suggested that we need to rethink the micro-foundation of capabilities development and more specifically that we need to study how cognition affects the early stages of capabilities development. Managerial Cognition relies on some simplification of the world called frames of reference. They help screen and filter the environment. Frames validate perceptions and perception validate the frame of reference (Cornelissen and Werner, 2014). While frames have been presented as rigid knowledge structures that have difficulties to make sense of unexpected events, it has also be shown that they can evolve (Kaplan, 2008) and that they can be reconstructed to overcome rigidities. This dichotomy has been suggested by a diversity of authors including Smith and Tushman (2005) to describe the handling of strategic contradictions and more recently by Garima and Bansal (2017) to describe effective and

ineffective collaboration between Business and NGOs. We have structured the following table to outline what can be described on one hand as cognitive rigidity versus cognitive fluidity.

Cognitive rigidity	**Cognitive fluidity**
Contradiction are rejected by privileging consistency over inconsistency (Smith & Tushman, 2005)	Contradiction is embraced by handling inconsistencies despite forces that push for consistency (Smith & Tushman, 2005)
When two options, conflict one of them has to be true and to prevail (Smith & Tushman, 2005)	Recognizing and accepting contradictory forces (Smith & Tushman, 2005)
Actors use enduring and fixed frames that select specific signals from the environment (Garima and Bansal 2017)	Actors 'align, or blend, cognitive frames, or elements of such frames, to derive new inferences (Garima and Bansal 2017)
Actors apply categorical labels that automatically triggers an interpretation and specific actions (Garima and Bansal 2017)	Actors start with a frame, but update the frame through experimentation and interaction with others (Garima and Bansal 2017)

We assume that cognitive fluidity will to a certain extent help build relevant inter-organizational and inter-personal linkages while cognitive rigidity will prevent from building them. Cognitive fluidity is expected to help reframe problems so distant capabilities can be gradually combined in order to deliver innovation.

Finally combining distant capabilities can be described as a composite concept that blends different perspectives including networks, cognition, proximity factors, capabilities, innovation, and entrepreneurship. It favors the study of phenomenon at multiple levels of analysis: the invention or product-service level, inter-organizational networks, interpersonal networks and cognitive frames. This has epistemological implications for our research framework. We would suggest that the core model presented above could be complemented by a diversity of theoretical viewpoints that should be considered in empirical work. Without trying to be exhaustive, we suggest underneath how different theoretical lenses offer insights that could help understand the evolution of inter-organizational and interpersonal linkages and contribute to combining distant capabilities. They are summarized in the following table

Theoretical view point	Complementary perspectives for our research framework
Clock-speed and timing (Fine, 2009)	Difference in terms of clock-speed across organizations impacts on their ability to synchronize their decision and execution cycles and therefore on how linkages functions effectively. This could be framed as a proximity factor. Very different clock-speed could be associated with distance and similar clock-speed with proximity
Customer Attractiveness (Huttinger, Schiele & Veldman 2012)	PSM literature has studies what makes a customer attractive and why and how they get preferential treatment. This stream of literature could help us understand why and how some

	organizations could decide to develop and strengthen some inter-organizational linkages at the expense of others
Architecture, modularity and Orchestration models (Brusoni & Prencipe 2013) (Nambisan & Sawhney 2011)	The architecture of an emerging innovation and the structure of the innovation network that delivers it influence each other (Chesbrough and Teece, 1996; Brusoni & Prencipe 2013). When standard product interfaces exist, the different organizations involved in the network tend to work on their components independently of each other, innovation can be coordinated across different organisations through information and knowledge sharing activities. However, when an innovation requires to redefine the architecture and the interfaces for an emerging innovation, this requires bringing diverse capabilities and source of knowledge together to explore; test and validate different options in terms of architectures Also Architecture and modularity also call for different orchestration models for innovation networks (Nambisan & Sawhney 2011) These affect Inter-organisational and inter-personal networks.

Conclusion

In the present paper, we have defined what we mean by combining distant capabilities. This was done by building on three research streams: the resource based view of the firm, the proximity school and the study of local vs distant innovation search process. We have shown that innovation result from the combination of an assortment of capabilities characterized by certain degrees of geographic, knowledge, social, institutional and organizational distance amongst them. More specifically, we have decided to focus on knowledge and organizational distance as the main characteristics of our research framework on how to combine distant capabilities. To do this, we have suggested a model where cognitive fluidity and cognitive rigidity impact on how inter-organizational and inter-personal linkages evolve over time. As linkages and managerial cognition co-evolve, distance is lessened and capabilities are progressively combined to deliver innovation. This framework offers some practical foundations to study how innovation occurs across organizations. Distance, managerial cognition, linkages together with their interrelations can be described and studied along a timeline. This offers practical advantages to understand how capabilities are combined, integrated and transformed into innovation and economic value over time. Indeed, aggregating exploration and exploitation within a single concept is essential to measure their combined impact on business outcomes, however to make sense of how innovation takes place, studying over time how managerial cognition, distances, interpersonal and inter-organizational linkages will offer us promising developments for our empirical and theoretical understanding of the micro-foundations of innovation. This can also be the base for a more normative theory that can guide practice. We should aim at understanding how firms can map the distant capabilities that could play a key role in their competitive and collaborative arena

and we should provide guidance on how to effectively combine distant capabilities. Further research should build on longitudinal case study that investgate how some distant capabilities have been combined to deliver innovation. We will need to map the evolution of linkages over time and to document the rigidity and fluidity of the cognitive process over time. This will call to record quantitative and qualitative data to understand the interplay between cognition, network and innovation with the aim to progress our academic understanding of how the economic and technological future is unfolding in front of us.

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Public procurement and innovation: A conceptual framework for analysing project-based procurement strategies for innovation

Abstract: This paper discusses a conceptual framework for analysing the use of public procurement strategies to stimulate innovation in projects. This framework is developed as part of an explorative study, which uses a multiple case study approach to gain a deeper understanding on *how* and *for what reasons* innovation is stimulated in projects. The framework allows for a systematic analysis of the decisions in project and procurement strategies, and how these decisions interact and influence the tender offers with respect to innovation. The framework can also be used by researchers and practitioners for evaluating the use of procurement of innovation strategies in projects.

Keywords: public procurement; innovation; project-based procurement;

Submission category: Working paper

1. Introduction

The interest in public procurement as an innovation policy instrument has increased considerably over the last fifteen years (Lember et al., 2011; OECD, 2011). A common policy rationale for stimulating innovation through public procurement is that innovation is widely accepted to lead to technological development, competitiveness and economic growth of nations, regions and private organisations. Moreover, the stimulation of innovation through public procurement is considered to play an important role in addressing the societal challenges we will face in the years to come.

Although the concept of stimulating innovation through public procurement, and its effectiveness with respect to other innovation policy instruments has perceived much attention in recent years, there is a lack of knowledge on how and for what reasons innovation is stimulated through public procurement by public organisations on the level of individual projects. Furthermore, there is a specific lack of knowledge on how decisions in project and procurement strategies interact and influence tender offers with respect to innovation. Many individual factors influencing innovation through public procurement can be found in literature. However, how goals in the project and decisions in the project and procurement strategy interact and influence tender offers with respect to innovation remains to a large extent a black box.

This paper presents a conceptual framework which can be used as a tool to: (1) investigate *how* and *for what reasons* public procurement strategies are used to stimulate innovation in projects, and (2) to analyse and explain how decisions in project and procurement strategies interact and influence tender offers with respect to innovation. In addition, the framework can be used by practitioners as a tool for evaluating the use of procurement strategies to stimulate innovation in projects. The paper first discusses the research methods used for developing the framework. After this, the theoretical background of the framework is discussed, followed by the conceptual framework itself. In the last part of the paper, the framework is applied on an example case to show its relevance and practical use as a tool for analysing projects in which innovation is consciously stimulated through public procurement. The paper ends with conclusions and a short discussion.

2. Research methods

An inductive approach is used for the development of the conceptual framework, which is based on a literature review and preliminary research. The literature review focused on public procurement, the use of procurement as an innovation policy instrument, and methods for stimulating innovation through public procurement. Preliminary research focussed on the use of public procurement to stimulate innovation in projects and was performed in close collaboration with two large municipalities. It included a document analysis of various procurement projects and procurement policy documents with respect to stimulating innovation, several interviews with four project managers of project in which innovation is stimulated, two policy makers, five procurement experts, and numerous informal discussions with civil servants working at various places within the municipalities.

The conceptual framework was tested and further developed in an explorative study focusing on *how* and *for what reasons* public procurement strategies are used to trigger, adopt and/or organize innovation in projects related to civil engineering and construction. The construction industry was selected as this sector presents a significant share of the procurement budgets, has a large influence on the economy, employment and the wellbeing of citizens, and the critical role it plays in addressing societal challenges such as the effects of climate change. To address these research questions an inductive multiple case study approach was selected (Eisenhardt, 1989; Eisenhardt and Graebner, 2007). One of the cases in the multiple case study is used in this paper to illustrate how the conceptual framework can be used as a tool in the analysis of the case.

3. Theoretical background

3.1. Project-based procurement

Procurement in projects is highly influenced by project logic, in which activities are performed and resources allocated to obtain a specific set of aims and objectives, within a clearly defined scope, timeframe and budget (Munns and Bjeirmi, 1996). To initiate a project two essential steps have to be taken. The first is the development of the *aims* of, *objectives* in, and scope of the project. The aims of the project are the higher goals to which the project should contribute, whereas the objectives in the project are specific goals within the project. The second step is the negotiation and allocation of budgets and resources to the project. Both steps are largely influenced by stakeholders who have different stakes and interests in the project, vary in their power to influence decision making in the project, and may or may not have budgets and resources to allocate to the project (Turner and Müller, 2003). For these reasons, the initiation of a project can be regarded as a political process in which decisions are taken with far-reaching implications for the rest of project, including the project and procurement strategy. Moreover, it acknowledges the importance of the interaction between projects and the *environment* in which they take place, including the historical and organizational context (Engwall, 2003).

Differences in stakes and interests of stakeholders also influence their perspective on what they regard as a successful project. As Shenhar et al. (2001) put it: “Project success means different things to different people”. Therefore, it is impossible to determine the success of a project without stating the criteria where it should be assessed against first. Traditionally, project success is often assessed in terms of its ability to meet time, budget and quality requirements

(Atkinson, 1999). Alternatively, the success of a project can be assessed against its ability to accomplish the pre-defined aims and objectives of the project (Artto et al., 2008). Assessing project success this way allows for a systematic analysis of decisions in the project and procurement strategy, and their influence on innovation in tender offers, with respect to the aims of and objectives in the project.

This is relevant with respect to the rationale for stimulating innovation through public procurement. From an innovation policy perspective, innovation is stimulated to foster the competitiveness and economic growth of nations, regions and firms (Edler and Georghiou, 2007; Lember et al., 2014). Yet, from the perspective of public organisations, innovation is mostly stimulated to: (a) respond to specific human needs and societal challenges (Edquist and Zabala-Iturriagagoitia, 2012), (b) serve the needs of the public organisation (Dalpé, 1994; Edler and Yeow, 2016), or (c) increase the quality of the products and services procured (OECD, 2011; Yeow and Edler, 2012). It is also possible to procure innovative products and services for other public organisations or private end users, which is called catalytic procurement (Hommen et al., 2005). The stimulation of innovation through public procurement are often part of a broader set of aims of and objectives in a project. However, in some cases the procurement or development of one or more innovations is a project in its own right (Yeow and Edler, 2012).

In conclusion, the stimulation of innovation through public procurement can play different roles in a project, which is linked to the rationale for stimulating innovation. From stimulating innovation in the private sector as a horizontal/secondary policy objective (Arrowsmith, 2010; European Commission, 2010), to the procurement of an innovative product and/or service as the main objective of the project (Yeow and Edler, 2012). As a result, the importance of stimulating innovation through public procurement for obtaining the aims of and objectives in the project can vary substantially.

3.2. Stimulating innovation through public procurement

The use of public procurement strategies to stimulate innovation in the private sector has been discussed under many terms, which are based on different concepts and rationales for stimulating innovation. Some examples are: public procurement for innovation or innovation procurement, previously known as public technology procurement (Edquist and Hommen, 2000; Edquist and Zabala-Iturriagagoitia, 2012); public procurement of innovation (Rolfstam, 2013); public procurement of innovative solutions (European Commission, 2014); innovation-friendly procurement (Uyarra and Flanagan, 2010), and pre-commercial procurement (Edquist and Zabala-Iturriagagoitia, 2015; European Commission, 2008). Despite some profound differences between these concepts, they all should be differentiated from innovative procurement, which refers to innovation in procurement processes, such as e-procurement (Moon, 2005). Although the use of novel procurement processes in order to stimulate innovation in the private sector is not uncommon, they should not be mixed up.

The OECD (2011) presents three different types of procurement strategies for stimulating innovation. The first type of procurement strategy, innovation-friendly procurement, focusses on making regular procurement practices more conducive to innovation (Uyarra and Flanagan, 2010). The second type is strategic procurement, in which public organisations demand new

technologies, products and services for addressing specific organisational needs and societal challenges (Edler and Yeow, 2016; Edquist and Zabala-Iturriagagoitia, 2012). The third type is the procurement of R&D services, in which public organisations use highly targeted subsidies to stimulate the development of new solutions for organisational needs or societal challenges (Edquist and Zabala-Iturriagagoitia, 2015; Georghiou et al., 2014). Usually with the aim to have several new solutions available for subsequent procured to fulfil organisational need or address societal challenges (European Commission, 2008).

Differentiating these types of procurement strategies is relevant as each procurement strategy type uses different methods to stimulate innovation and targets innovations in different stages of development (Hommen and Rolfstam, 2009). From adopting innovations which are directly applicable and procuring innovations which require more R&D before implementation, to triggering the development of new innovations. Further, the procurement strategy types vary in terms of the expected time, expertise and resources needed from the public and private organizations to be performed.

3.3. Methods for stimulating innovation through public procurement

Regular public procurement can affect innovation by influencing the *demand* for certain products and services or by specifying *requirements* and *standards* for procured products and services (Caerteling et al., 2008; Dalpé et al., 1992). In addition, there are several methods to make regular public procurement more conducive to innovation. Most of the methods discussed in literature are either related to (a) providing *incentives* to candidates to innovate and/or offer additional quality and innovative solutions in their tender offer, or (b) to increase the *solution space* within the tender assignment to include alternative and innovative solutions.

Several papers discuss demand for new products and processes as an important factor for stimulating innovation in the private sector (Edler and Georghiou, 2007; Geroski, 1990; Mowery and Rosenberg, 1979). Increasing the demand provides *incentives* for potential suppliers to innovate as it decreases the uncertainty of future sales (van Meerveld et al., 2015). Other well-known methods for stimulating innovation by providing incentives to innovate are: (a) performance-based tendering instead of awarding based on lowest price (Dreschler, 2009), (b) placing an order for the fulfilment of needs which cannot be met through conventional solutions (Edquist and Zabala-Iturriagagoitia, 2012), (c) including high quality standards in tender specifications (Dalpé, 1994), and (d) favourable arrangements on intellectual property rights (Butler, 2014).

On the other hand, there are several methods which work by increasing the *solution space* of offers which are accepted by the procurement organisation. The most common method is the use of functional specifications instead of technical specifications, to specify the needs and requirements of the tender assignment, (Dalpé, 1994; Uyarra et al., 2014). Another method is to explicitly accept alternative solutions when using technical specifications (Butler, 2014). Somewhat less obvious from the literature is the impact of external requirements on the solution space. Some examples are: requirements from policy documents, stakeholders and legislation, or requirements for obtaining permits and approval of the fire department.

Methods for increasing the solution space, as well as methods for providing potential candidates incentives to innovate primarily focus on the tender phase of the procurement

process. Methods for stimulating innovation through *market approach*, on the other hand, are more inclined to the pre-procurement phase and when applicable, the pre-selection of potential suppliers. A first method is to perform a market sounding and consultation. They can be used to communicate the needs and requirements of the public organisations to potential candidates, to obtain feedback on the feasibility of the assignment and interest from potential candidates, and foster collaboration and the development of consortia between candidates (Lenferink et al., 2012; van Meerveld et al., 2015). Innovation can also be indirectly influenced through the requirements and selection criteria used for the pre-selection of eligible candidates. These requirements and selection criteria determine to a large extend what type of potential candidates, with different innovation capabilities, will be invited to put in an offer for tender. A third method associated with the market approach is the use of procurement procedures which allow for more communication between the public organisation and candidates during the procurement process. Two examples of these are the competitive dialogue and the competitive procedure with negotiation (Telles and Butler, 2014).

Lastly, several studies state the importance of articulating the needs of the procurement organisation in relation to simulating innovation (Dalpé, 1994; Edquist and Zabala-Iturriagagoitia, 2012). The underlying idea is that the *focus* on innovation, and to what it should contribute, can steer the direction of innovation efforts and the inclusion of innovations in tender offers. The focus on innovation, and to what it should contribute, is highly related to the rationale for stimulating innovation through public procurement.

4. Conceptual framework

The conceptual framework, presented in figure 1, describes the interaction between the contracting authority and the candidates and tenderers leading to the development and submission of tender offers by tenderers. More specifically, the framework can be used to: (a) analyse and evaluate the use of public procurement strategies for stimulating innovation in projects with respect to the scope and aims of, and objectives in the project, and (b) help explain how decisions in the project and procurement strategy interact and influence the offers submitted by the tenderers with respect to innovation.

The scope and aims of, and objectives in the project are regarded as input for the development of the project and procurement strategy of the contracting authority. The aims of the project indicate the goals to which the project should contribute, whereas the objectives in the project indicate the goals within the project. Note that in some cases, decisions in the project and procurement strategy can also influence the scope and aims of, and objectives in the project.

The project and procurement strategy is conceptualised as a list of decisions which are: (a) of importance with respect to stimulating innovation, (b) of importance to obtain the aims of and objectives in the project, or (c) of importance to both. Each of these decisions are categorised in one or more of the four identified categories of ways through which innovation can be influenced by the decisions in the project and procurement strategy. These categories were identified based on a literature review and preliminary empirical research. Decisions in these categories are related to:

- provided *incentives*/disincentives for tenderers to provide innovative solutions, including financial incentives, distribution of risks related to innovation, expected future demand and arrangements on intellectual property rights;
- provided *solution space* for eligible tender offers, including the specification of the assignment and requirements, externally imposed requirements, and optionally the acceptance of alternative solutions;
- selected breath and degree of *focus on innovation* within the project and to what it should contribute; and
- selected *market approach*, including market analysis and communication of the tender assignment to potential candidates, selection of eligible candidates, and the interaction with candidates and tenderers before and during the tender procedure.

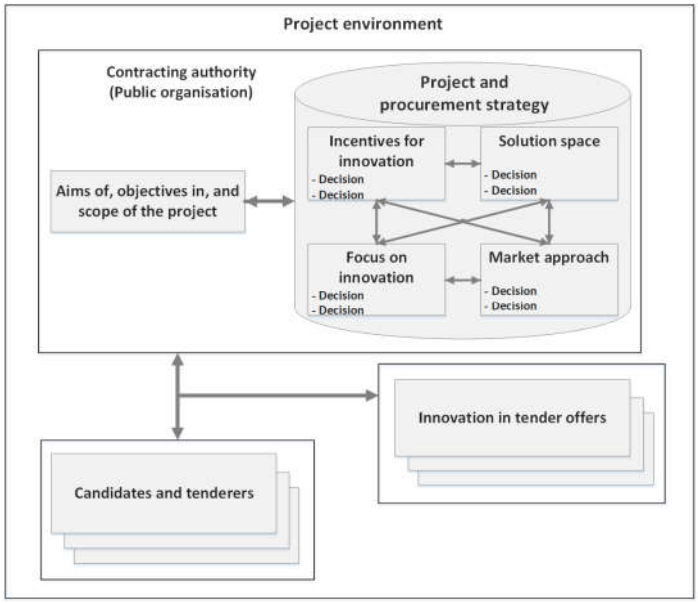

Fig. 1. Conceptual framework for analysing public procurement strategies for stimulating innovation in projects.

It is possible that one decision influences innovation through different ways and therefore belongs to multiple categories. An example is the decision to limit the breath of the *focus on innovation* in the award criteria to a specific part of the project (Decision J in the case below). This provides *incentives* for tenderers to include innovations with respect to that part of the project, whereas is provides disincentives to include innovations with respect to other parts of the project. The degree of focus on innovation in the award criteria in the case is expressed through the fictional reduction in tender price, which tenderers are likely to be able to obtain for including their innovations in the tender offer, with respect to the other award criteria.

The project environment is added to the conceptual framework to acknowledge that decisions in projects are not made in isolation, but are influenced by the environment in which the project takes place. This includes the interests and power position of relevant stakeholders with respect to the project. As a result, the project environment should be included in the analysis of projects with respect to the use of procurement strategies to stimulate innovation in tender offers, and their role in obtaining the aims of, and objectives in the project.

5. Applying the conceptual framework to the case "The Boekelosebrug"

To show the relevance and practical use of the conceptual framework in the analysis of projects in which procurement strategies are used to stimulate innovation, the framework is applied on the case "The Boekelosebrug" as an example. Due to page limitations the analysis is very concise, a bit clinical and includes: a short case description with the scope, aims of and objectives in the project; key decisions in the project and procurement strategy, and how they influenced tender offers with respect to innovation. The purpose of this analysis is to show in how the conceptual framework can be used as a tool for analysis, not to provide an exhaustive analysis of the project.

5.1. Short case description

The tender assignment of the Boekelosebrug consisted of the design and realisation of new bridge across the channel on the south-side of city of Hengelo, to replace the old bridge. Further, it included the realisation of a part of the avenue providing access to the city centre from the south side of Hengelo. The bridge is part of this avenue, and the project the Boekelosebrug as a whole, is part of a large area redevelopment project called "Hart van Zuid", on the south side of the inner-city.

The *aim* of the project was "to improve the accessibility, traffic flow and traffic safety of Hengelo within time and budget restrictions of the project". In addition, the project aimed to: (a) realise added value through the application of product- and process innovations, (b) realising of an architectural appealing bridge of high aesthetical quality fitting within the pre-established spatial guidelines for the design of the bridge ("ruimtelijke kaders" in Dutch), and (c) minimalizing inconvenience and nuisance to citizens due to the realisation of the project. The *objectives* in the project were: (a) to replace the old bridge by a new bridge, which allows for more and heavier traffic and is designed and realised within the predefined requirements for the bridge, and (b) the realisation of the southern part of the avenue "Laan van Zuid" according to design specifications.

5.2. Key decisions in the project and procurement strategy

Due to the focus on architectural and aesthetical quality of the bridge was decided to combine the design and realisation of the bridge in one assignment (Decision A). Within the assignment there was a lot of design freedom with respect to the bridge, with possibilities to design a plate-, arch or cable-stayed bridge (D B). However, with respect to the realisation of the avenue the solution space was limited due to elaborate design specifications (D C). The European restricted tender procedure was used for this assignment (D D). In the selection stage, the number of eligible candidates for tender was reduced based on their ability to perform the five pre-defined core competences integrally, the extent to which innovation is a part of their corporate strategy, and their relevant achievements with the development and application of innovations in projects comparable to this assignment (D E). In the tender stage, tenderers could obtain a max. fictive reduction on their tender price of € 4,25 M for providing additional quality on top of the base requirements. The maximum allowed tender price was € 8,2 M (D F). The criteria for assessing the additional offered quality were: (a) architectonical and aesthetical quality of the design of the bridge max. € 3 M (D G), (b) extent of and scale of innovation in the innovations offered max. € 1 M (D H), and (c) reduction in time needed for the realisation of the work max. € 0,25 M (D I). Other key decisions were: defining definitions

of product and process innovation in relation to the project, the three categories on the extent of innovation, and the three categories on the scale of innovation (D J); specific request to include three product and/or process innovations in the offer for the design and realisation of the bridge (D K); the use of a traditional market approach with written communication (D L) and the decision to not perform a market consultation as part of the market analysis (D M).

Table 1
Key decisions in the project and procurement strategy.

Incentives	Solution space	Focus	Market approach
Decision E	Decision A	Decision E	Decision E
Decision F	Decision B	Decision H	Decision L
Decision G	Decision C	Decision I	Decision M
Decision H	Decision K	Decision J	
Decision I		Decision K	
Decision J			

5.3. Influence of decisions in the project and procurement strategy on tender offers

The adoption of innovative solutions in the project was one of the aims of the project, partly motivated by the requirement of the Province of Overijssel to stimulate innovation in the project for getting funding from them for this project. Within the project was decided that the innovative solutions should provide an added value to the bridge design/performance and/or the realisation process of the project, without prescribing what type added value this should be to provide a broad solution space with respect to eligible innovations. This combined with: (a) a selection of candidates partly based on innovation criteria, (b) sufficient financial incentives to provide innovative solutions as part of the tender offer, and (c) sufficient solution space to include product and process innovations, resulted in a broad range of bridge designs, product and process innovations in the tender offers. Hence, it is the combination of decisions which resulted in the inclusion of innovations in the tender offers.

The large range of ways in which innovations were allowed to provide additional value was used by tenderers to offer a large variation of product and process innovations. Each with their own benefits. Though some more relevant than others with respect to the design/performance of the bridge and/or realisation process of the project. The winning tenderer provided (1) a process innovation using augmented reality for the positioning of the bridge, (2) a product innovation to make the bridge energy neutral by means of solar panels in the road, and (3) the use of a low baked powder coating in an outside environment (product innovation).

This in a nutshell, provides some insight in *how* public procurement strategies were used to adopt innovations in the project, to what these innovations should contribute, and *for what reasons* innovation was stimulated in the project. Nevertheless, one should note that this is a highly stylised and simplified version of the analysis due to page limitations. As such, this analysis cannot explain the full complexity of, and the considerations behind, the decisions made in the project and procurement strategy and how they influence tender offers with respect to innovation.

6. Conclusions and discussion

This paper presents a conceptual framework for analysing the use of public procurement strategies to stimulate innovation in projects. More specifically, the framework can be used as a tool to: (a) analyse and evaluate the use of public procurement strategies for stimulating innovation in projects with respect to the aims of, objectives in and scope of the project, and (b) help explain how decisions in the project and procurement strategy interact and influence the offers submitted by the tenderers with respect to innovation. As such, the framework provides a structure for the analysis and comparison of different projects. This in turn can be used to facilitate learning and knowledge exchange, on the use of public procurement strategies for stimulating innovation, across projects and organizations.

Based on a literature review and preliminary empirical research four categories of ways through which innovation can be influenced by decisions in the project and procurement strategy were identified. Decisions in these categories are related to:

- provided *incentives*/disincentives for tenderers to provide innovative solutions;
- provided *solution space* for eligible tender offers;
- selected breath and degree of *focus on innovation* within the project and to what it should contribute; and
- selected *market approach*, including market analysis and communication of the tender assignment to potential candidates, selection of eligible candidates, and the interaction with candidates and tenderers before and during the tender procedure.

The framework is contributes to the analysis of projects by unravelling the project and procurement strategy in a list of decisions, which are taken to obtain the aims of and objectives in the project and/or to stimulate innovation. Subsequently, categorising these decisions based on the way they are expected to influence innovation helps to analyse and explain how the project and procurement strategy as a whole influences innovation in the tender offers.

Despite the logical mechanisms behind the ways through which innovation is stimulated/hindered in each of the identified categories, it could be that a fifth category, or different way of categorising decisions in the project and procurement strategy, will provide different insights and/or bias. Further, it is important to realise that: (a) aims of, objectives in and scope of the project, (b) decisions in the project and procurement strategy, and (c) the project context, may change over time. If this occurs it is important to investigate when and why they have changed as part of the analysis.

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Sustainability assessment in the fresh fruit and vegetables supply chain

Abstract

Despite the growing attention to sustainability, in sensitive industries as food, limited attention has been devoted to sustainability assessment at the different stages of the supply chain. The aims of this study are to investigate how different stages in the food supply chain address sustainability assessment, and to identify the elements that could motivate companies to assess sustainability. Twelve cases operating in four stages of the fresh fruit and vegetables supply chain in Italy were studied. The analysis shows that the sustainability assessment is highly heterogeneous for the practices implemented, and that such assessment is not dependent on the supply chain stage but on the type of practice. The factors that foster sustainability assessment are company size, complexity of the measurements and the level of vertical integration.

Keywords: Sustainable supply chain, sustainability assessment, food industry

Submission category: Competitive Paper 17

Introduction

Sustainable supply chain management responds to increasing pressures from stakeholders, policymakers, and consumers for companies to devote efforts to environmental and social sustainability (Seuring and Müller, 2008; Gualandris et al., 2015; FAO, 2014; European Commission, 2014). Accordingly, literature has grown as well with studies about sustainable practices, drivers and performance indicators, in different industries and with different supply chain scopes.

Specifically, this study focuses on the performance measurement in the supply chain that concerns the application of groups of measures in different stages of the chain (Beamon, 1999). Furthermore, this study addresses sustainability performance measurement involving the application of different measures in environmental, social and economic areas. Authors claim that the use of indicators and-or measures for assessing sustainability in different stages in the chain, increases the complexity to develop an effective assessment system (Gualandris et al. 2015; Trienekens et al. 2012). Along with that, given the diversity of sustainability indicators in literature, the assessment risks to be ineffective when companies do not know how practices should be evaluated and for what reasons (Bourne et al. 2002). Therefore, the need of understanding how companies in the supply chain assess sustainability arises together with the aim of identifying the company's features that foster sustainability assessment.

The food industry is characterized by unique sustainability challenges. Scarce natural resources that need to be preserved, attention to consumer's health and safety, communities' economic development around the world, are only some of them (Pullman et al. 2009; Maloni and Brown, 2006; Beske et al. 2014). Unsurprisingly, this industry that deals with increasing stakeholder's demands for better sustainability performance in the triple bottom line (i.e, environmental, social and economic) has started developing assessment policies, standards and reporting (Bloemhof et. al, 2015; Trienekens et al., 2012; Bourlakis et al. 2014) in the attempt of fulfilling such expectations.

In Italy, the food industry is the second most important economic sector in terms of production volumes, import and export (Foodweb, 2015), representing one of the main income sources for the country. Many different products are cultivated and exported around the world. In the EU, Italy is the second main fruit and vegetables processor and third main exporter, thanks to the various microclimates that characterize the food variety in the country (Eurostat, 2016). From the variety of Italian products available in the market, this study is concentrated in the fresh fruit and vegetables (FF&V) supply chain, analyzing four stages: growers,

processors, wholesalers and retailers. Twelve companies with operations in one or more of the four stages were studied with two objectives. First, to understand how different stages in the food supply chain address sustainability assessment. Second, to identify the elements that motivate sustainability assessment in this food supply chain. The study is grounded on the stakeholder theory as it helps to analyze and interpret the findings based on the argument that companies implement sustainability to gain competitive advantage and to respond to stakeholder pressures (Sarkis et al. 2011). Besides, given the pressures exerted by stakeholders are important for companies, it becomes crucial to measure the firm´s ability to respond effectively (Freeman et al. 2010). Findings in the study characterize the variety of sustainability practices implemented in different stages of the FF&V supply chain, as well as the diverse assessment methods used to evaluate or monitor such practices.

In the following, the paper presents a comprehensive literature review about sustainability in the food supply chain management and about assessment food supply chain; next, the research questions and methodology are described; and finally, the data analysis, findings and discussion are explained.

Conceptual Background

Sustainability in the food supply chain

The food industry needs to deal with increasingly demanding expectations of product quality and availability for the growing population, and also with an accelerating environmental and social impact assessment policies and standards to respect (Bloemhof et. al, 2015; Fritz and Matopoulos, 2008; Banterle et al. 2013). Consumers are becoming more concerned with the products they consume, including their origin, the inputs used during production, the labor standards implemented and the environmental impact of production (Trienekens et al., 2012; Maloni and Brown, 2006; Pullman et al. 2009). Hence, as Schmitt et al. (2017) mentioned, the sustainability of food production is implicitly multidimensional, involving environmental care, social wellbeing, and economic performance.

Accordingly, the significance of sustainability in the food industry is revealed by the vast number of practices, projects and/or initiatives deployed, and the increasing contributions in literature regarding the study of environmental and social sustainability practices. For instance, Maloni and Brown (2006), Banterle et al. (2013), Beske et al. (2014), Pullman et al. (2009), Trienekens et al. (2012) have identified different sets of sustainability practices to be applied in the food supply chain, and together with guidelines provided by international organizations (UN Global Compact, 2012; FAO, 2014; European Commission, 2014; IFOAM, 2005; ISEAL, 2014) can be summarized in the following seven categories:

- *Emissions reduction and resource preservation*: this category refers to all the practices involving actions and techniques in food production, processing, packaging and transportation that aim to reduce emissions and the use of pollutant chemical substances, e.g. responsible farming methods (reducing fertilizer and pesticides), elimination of contaminant and pollutant agents, reducing CO2 emissions and GHGs, reduce pollution.
- *Resource efficiency*: this category includes the practices that improve sustainability by increasing resources and processes' efficiency. For instance, reducing water consumption, efficient water use, waste water re-use and recovery. Other practices include reducing energy use, energy conservation, reducing the use of other input materials, reducing fuel consumption, and optimization of transportation and logistics processes.
- *Waste reduction and packaging*: this category includes the practices and initiatives to reduce waste that could be food or packaging material. For example: to reduce waste throughout the production, packing, transportation and storing processes, to decrease

and/or eliminate hazardous materials, to compost organic waste, to produce renewable energy or animal feed with food waste, food and material recycling. In particular, regarding packaging: reuse and recycling, reducing packaging, using reusable/ recyclable packaging, sustainable packaging design (e.g., an appropriate packaging can allow longer food preservation and also to reduce food waste).

- *Health and Safety*: refers to the practices that help ensuring and increasing consumer's health and safety, i.e., product quality and control, reducing contamination risk (food safety and security), traceability, promotion of healthier products and diets, communication and education to consumers.
- *Labor and Human Rights*: are all the practices to improve the working conditions and enhance workers' wellbeing, for example: regular employment, training, education, respect of worker rights, safe working environment, fair compensation. These practices can be either regulated or voluntarily applied by the companies in the supply chain.
- *Community*: this category refers to the practices aimed at supporting local communities, philanthropic initiatives, contributions to improve quality of life in the community, educational projects, health campaigns, promote gender equality and diversity, respect local biodiversity.
- *Ethical trade:* This dimension is even more resonated for food industry given the relationship of food and social and economic development in many geographies. Several certifications schemes promote ethical practices and transparency between buyers and suppliers, to improve the quality of life thanks to a premium price for sustainable-grown products, respect and fairness.

However, the identification of practices implemented in different supply chain stages has not been yet individualized per stage neither the performance assessment understood per stage. As Gualandris et al. (2015), mentioned, the range of issues or dimensions that a company considers in its sustainability efforts will determine the scope of the sustainability evaluation. Hence, it is important to identify the sustainability practices implemented per supply chain stage prior determining an assessment system.

Sustainability assessment in the supply chain

The increasing stakeholders' demands for better sustainability performance have triggered the interest on sustainability performance measurement. However, measuring sustainability is highly complex given that it involves social and environmental issues that cannot easily be translated into economic indicators.

Some authors have proposed frameworks to deal with sustainability measurement in the supply chain for different industries and for food in particular. Mostly they have concentrated on determining the areas to be evaluated and defining the measures or indicators, e.g., Aramyan et al. (2007), Fritz and Motopulos (2008), Varsei et al., (2014), Yakovleva (2007), Bloemhof et al. (2015), Ilbery and Maye (2005), Arena and Azzone (2012). However, the vast number of indicators in literature risks to make the assessment ineffective, especially when companies do not know how and why practices should be evaluated (Bourne et al. 2002). In this line, Genovese et al. (2017) pointed out that the main challenge for companies is to identify which indicators to apply for the environmental assessment without overloading users with too many measures and avoiding information redundancies, thus evidencing the need for simpler assessment with core indicators.

In addition, regarding sustainability assessment in the supply chain, Gualandris et al. (2015) define sustainable evaluation and verification in the extended supply chain, as all the activities related to measures' identification, data collection and processing, data verification and disclosure. The authors discuss how focal companies in a supply chain could deploy a

sustainability evaluation strategy, considering different stakeholders' requirements, firm capabilities and the degree of supply chain integration. Consequently, the sustainability assessment system (methods/ techniques applied for measuring, monitoring and controlling sustainability) will vary between firms in the supply chain according to the scope or range of issues to be measured and how are they measured, if they are.

In order to better understand how companies in the supply chain are assessing their sustainability efforts, we identified the main sustainability assessment methods mentioned in literature and summarized in the following groups:

- *Absent*: when there is no sustainability assessment even if one or more sustainability practices are implemented.
- *Non- Structured*: refers to the case when sustainability practices are assessed in some way, but the assessment is limited to an economic or operative perspective. For example, as in the dimensions proposed by Aramyan et al. (2007): efficiency, flexibility, responsiveness; or as Varsei et al. (2014) proposed for economic performance: cost and service level; or productivity as proposed by Fritz and Matopoulos (2008). In these cases, data collected for evaluations is not used to assess sustainability per se.
- *Structured*: when there is a structured performance measurement system that is formalized and integrated with other systems in the company. For instance, systems that are integrated with the accounting, planning and/or manufacturing areas; and are used for control, evaluation, coordination and benchmarking of activities (De Toni and Tonchia, 2001). In the case of sustainability performance measurement systems, some schemes are proposed in literature and industry such as the GRI (Global Reporting Initiative) that provides a set of indicators in the sustainability triple bottom line; the LCA (life cycle assessment) that provides a method to determine a product environmental impact; and other in-house developed reporting systems, codes of conduct, own sustainability reports, fall into this category.
- *Certification*: is the most formal performance measurement system. Certifications are structured, provide standardized guidelines that are shared with all the actors adopting them, and are assessed by specialized third-parties (i.e. certification bodies). Sustainability certification schemes are usually complex and demanding in terms of time and resources investment requirements, because they imply interactions with external actors or organizations (Gualandris et al. 2015), but they are internationally recognized and help companies to ensure compliance, to gain competitive advantage, to optimize processes and reduce risks (Trienekens et al. 2012, Gualandris et al. 2015). Specifically, for the food supply chain, some of the most renowned sustainability certifications are: the BRC (British Retail Consortium), IFS Food (International Featured Standards), FTI (Fair Trade international), RFA (Rain Forest Alliance), IFOAM (organic food consortium), UTZ. (Trienekens et al., 2012; Gualandris et al. 2015).

The four abovementioned groups refer to the different levels of assessment that a company could apply for all or some practices implemented. All of them, however, focus mainly on single companies, sometimes including the relationships with supply chain partners, but to our knowledge, none of these frameworks explains the way different supply chain stages assess different sustainability practices. This issue becomes relevant as it is necessary to consider that each stage has its own objectives, capabilities and strategies, and may face different pressures or challenges for performance measurement (Genovese et al. 2017). Furthermore, as Gualandris et al. (2015) and Trienekens et al. (2012) posit, sustainability assessment and transparency varies between firms and between supply chains, according to intrinsic and extrinsic food product attributes, firm capabilities, stakeholder's importance, and supply chain integration.

Hence, in this study we address the need to identify how sustainability practices are assessed in different supply chain stages and the company's features that foster sustainability evaluation.

Research questions and context of study

Food industry in Europe is one of the main economic sectors in terms of number of companies, revenues, and employment. In Italy, this industry represents132 billion € turnover, 58,000 companies and employs more than 1,2 million people (Foodweb, 2015). In the EU, Italy is the second main fruit and vegetables processor and third main exporter, thanks to the various microclimates that characterize the food variety in this country (Eurostat, 2016). The characteristics of this supply chain provide an interesting scenario where the complexity for sustainability implementation and assessment exists: high perishability, high product variety and packaging sizes, long production times, long set-up times, high set-up costs. (Kaipia et al., 2013).

Recalling the gaps identified in the previous sections, this study intends to focus its attention on the sustainability assessment that companies in different stages of the FF&V supply chain apply, and if there are specific elements that motivate such assessment. We considered stakeholder theory as the most appropriate lens for this study as it suggests companies implement sustainability practices with the expectation of gaining competitive advantage, besides, such implementation is considered essential because of the various stakeholder´s pressures (Sarkis et al. 2011). In this line, companies should take into account how well a specific practice help them to achieve their objectives and to deal with stakeholder influences (Freeman et al. 2010). Therefore, the sustainability assessment is necessary to understand if the company is attaining its performance objectives and improving relationships with stakeholders as well (Freeman et al. 2010; Clarkson, 1995).

Accordingly, the first objective in this study is to understand how different stages in the fresh fruit and vegetables (FF&V) supply chain address sustainability assessment, with the perspective of different stakeholders involved. Therefore, we first need to describe the type of sustainability practices implemented, and then to identify if they are evaluated or monitored in any way. Hence, the first research question in this study is:

Research question 1:

How are sustainability practices assessed in the FF&V supply chain?

On the other hand, not all companies develop a sustainability assessment strategy nor even apply indicators because as (Bourne et al. 2002) explain, they do not know what to measure and how. Moreover, bearing in mind Gualandris et al. (2015) arguments regarding how different stakeholder´s pressures and companies 'capabilities shape a firm´s sustainability performance assessment strategy, the second objective in the study is to further characterize if there are any elements that motivate sustainability assessment in the FF&V supply chain. Thus, the second research question in this study is:

Research question 2:

How stakeholder characteristics contribute to the application of sustainability assessment in the FF&V supply chain?

Methodology

A case-based methodology was selected. The study involves multiple cases with the objective of collecting evidence that offers the possibility to compare behaviors (Eisenhardt and Graebner, 2007) regarding the sustainability approach in different firms of the Italian FF&V supply chain. In a first screening, we selected companies in the FF&V food industry, registered in a national database, associations and cooperatives databases. Following, companies were selected because they have set up a sustainability strategy in their operations within different

axes of action: specific sustainability strategy, development of organic product lines, higher attention to product quality and traceability, sustainability reporting, etc. Lastly, cases were selected according to their availability and willingness to participate in the research. The final sample is composed by 12 companies of different sizes, geographical locations and levels of vertical integration, that is, different business units are integrated in one legal entity (Trienekens et al. 2012) and thus, operate in more than one stage of the chain (Gualandris et al. 2015; Arena and Azzone, 2012). The supply chain stages considered in this study are: *Growers*, *Processors*, *Wholesalers*, and *Retailers* (see Table 1 and Figure 1).

Table 1 –Cases under study

Case	Product	Sales [mln €/year]	Supply chain Stage
A	Fresh fruit	1	Grower
B	Fresh fruit and vegetables	2.100	Grower, Processor, Wholesaler
C	Fresh vegetables	32	Grower, Processor, Wholesaler
D	Fresh fruit and vegetables	230	Grower, Processor, Wholesaler
E	Fresh fruit	34	Grower, Processor, Wholesaler
F	Juices and canned vegetables	400	Processor
G	Dried fruit and juices	110	Processor
H	Frozen vegetables	N/A	Processor
I	Fresh fruit	14	Wholesaler 2
J	All	12.400	Retailer
K	All	200	Wholesaler, Retailer
L	All	1.000	Retailer

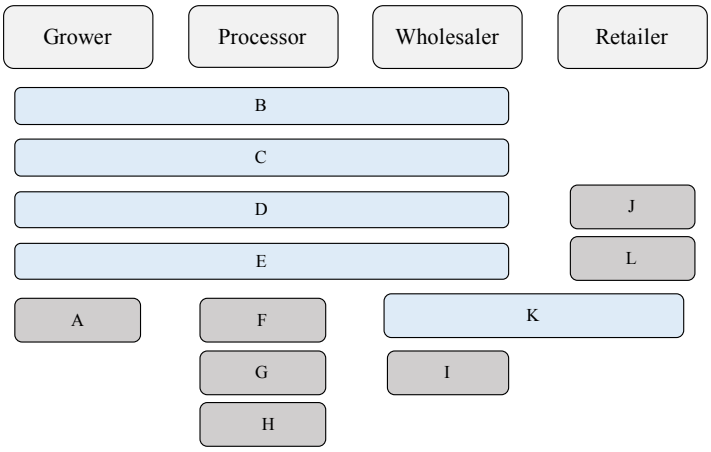

Fig. 1: Cases of study- Distribution across FF&V supply chain stages

Growers are the companies cultivating and harvesting the fruit and-or vegetables. Usually, they clean and sell the product in bulk without particular packaging. *Processors* are the companies in charge of some kind of product processing or transformation, e.g., portioning, boiling, grinding, squeezing. They also classify, weigh and pack the product before selling. *Wholesalers* are in charge of collecting and warehousing the fruit and-or vegetables prior distributing to the retail. Quality control and reconditioning are some additional activities that these companies could perform. Lastly, the *Retailers* are the companies that sell the products directly to consumers. Before displaying the product in the shelves, one or more points of quality control could be performed, as well as reconditioning the product in different packaging presentations (e.g., carton boxes, plastic or Styrofoam trays, plastic or paper bags). In addition, these companies commonly handle product waste recovery that can be destined to processing, re-processing, re-selling or for donating. Thus, the companies selected provide a pertinent scenario

to study the diverse sustainability practice implementation and assessment, across the FF&V supply chain, that is, in multiple stages, with companies of various characteristics.

Data collection and analysis

Data were collected from several sources as semi-structured interviews, companies' websites, online publications, and when available, the company's annual sustainability report. In addition, some of the companies provided internal documentation reporting sustainability projects and results. The use of multiple sources for data triangulation was helpful to ensure construct validity as well (Eisenhardt and Graebner, 2007; Yin, 2009).

In particular, the interviews followed a semi-structured approach that is, researchers followed a pre-defined protocol (See Appendix A) while allowing the interviewee to develop his/her ideas, and this way the researchers were able to take advantage of emergent themes and unique case features (Eisenhardt, 1989). Three researchers developed the interview protocol based on the literature review, then it was validated and updated as interviews went on. Two or three researchers conducted the interviews and transcribed the data. Data analyses were revised and updated as new data was collected for each case. Researchers worked on variables identification, as well as patterns recognition, first individually for avoiding bias, then in group for validation and agreement.

Data analysis was performed in three steps: within case, cross-case and cross-stage. Accordingly, first, variables of the study were analyzed within each case for identifying the sustainability practices implemented in each company and assessment applied, if existing. Second, a cross-case analysis involved the comparison of company's behavior in terms of practice' implementation as well as assessment, for pattern identification in cases in the same supply chain stage. Finally, a cross-stage analysis involved the comparison of sustainability practices and assessment applied across the different supply chain stages studied.

Findings

In the following, findings for each research question are described, firstly, for analyzing the sustainability practice ´assessment it is necessary to characterize the sustainability practices implemented in different stages of the supply chain with the perspective of different stakeholders. Secondly, the elements identified as motivators for sustainability assessment are described.

Sustainability practices in the FF&V supply chain

With the aim of answering the first research question, a within case and a cross-case analysis were performed. The sustainability practices implemented in the FF&V supply chain were identified in the cases analyzed and then aggregated per supply chain stage.

A total of 92 different practices were found, with 279 observations. We noticed that attention to sustainability is not equally distributed among the sustainability areas: approximately 65% of the practices falls in: "Emissions reduction and resource preservation", "Waste reduction and packaging" and "Health and safety" areas (See Figure 2).

Following, the cross-case analysis implied the aggregation of observations per stage in order to understand the commonalities and the differences between practices adopted. In the *Processor* and *Retail* stages, practices are mostly in three main areas mentioned before: "Emissions reduction and resource preservation", "Waste reduction and packaging" and "Health and safety". On the other hand, the *Grower*'s sustainability behavior is almost entirely to the practices for crop protection and reduction in the use of pesticides. Companies recognize that even if the cost of production could be higher, they intend to develop products that are safer and healthier for consumers who are willing to pay a premium price. All companies in this stage are committed to this practice. Lastly, *Wholesalers* were found as the stage that implement the

lowest number of sustainability practices. Two common factors causing this effect were identified. First, company size (smaller companies are unable to run long-term investments for sustainability), and second, vertical integration (most companies in this stage are integrated with processors and growers and thus sustainability practices are concentrated in those business units).

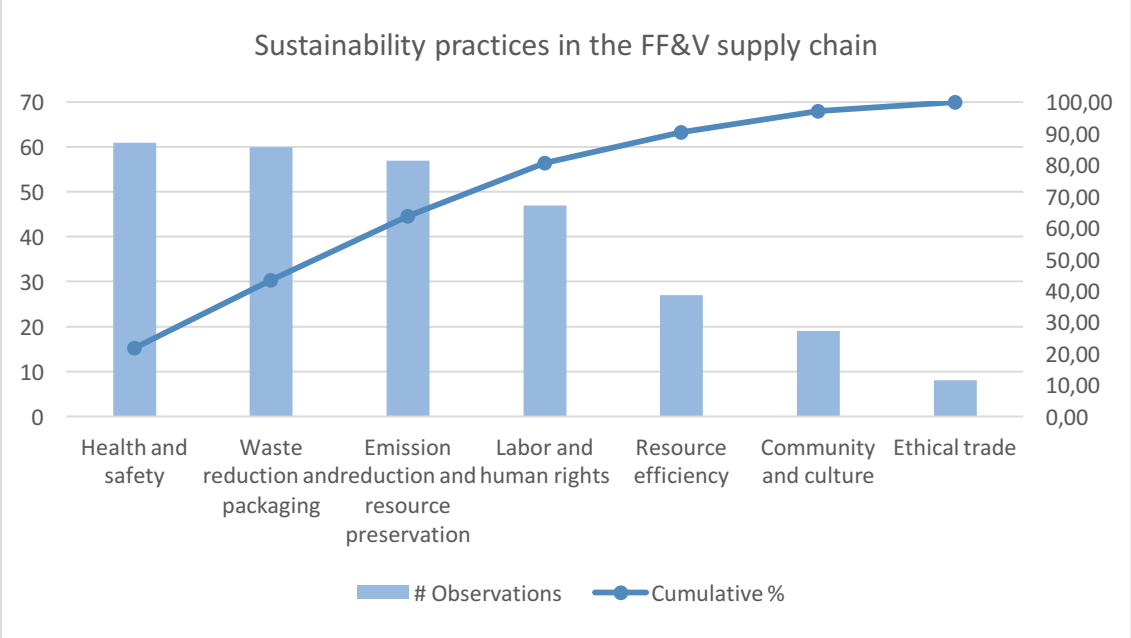

Fig. 2: Sustainability practices implementation in the FF&V supply chain

Sustainability assessment in the FF&V supply chain

In order to complete the answer to Research Question 1 we needed to identify which practices are assessed, if any, and how. Figure 3 summarizes the findings, showing that approximately half of the practices are either not assessed or assessed in a non-structured way, which means that even if companies are in fact assessing their sustainability practices, there is not a standard or unique way of doing such assessment in this supply chain.

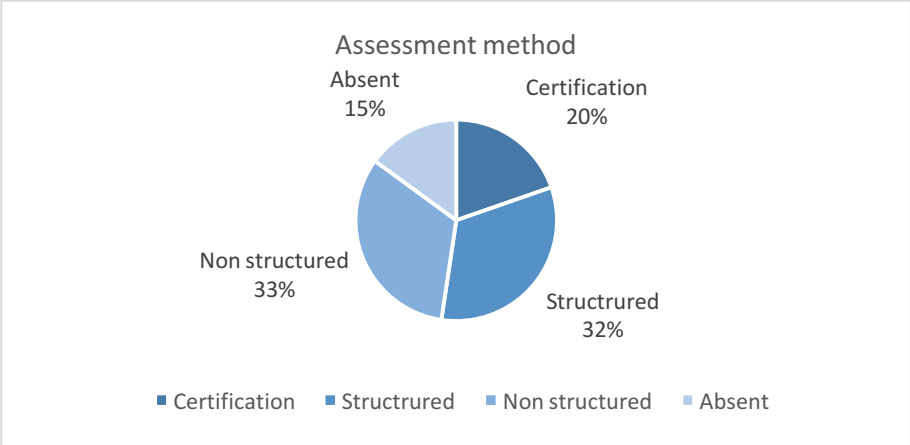

Fig. 3: Assessment methods used in the cases studied

On the other hand, looking at the type of practices implemented, a higher variety in the distribution of the assessment methods applied was observed. In Figure 4 we can observe for example that "Health and Safety" practices are mostly assessed with a certification or in a

structured way, allegedly because these practices are essentially regulated. Whereas, in the "Emissions reduction and Resource preservation" and "Labor and Human Rights" areas, all kind of assessment methods are present. Thus, it is observed that highly heterogeneous assessment mechanisms are applied in the companies under study.

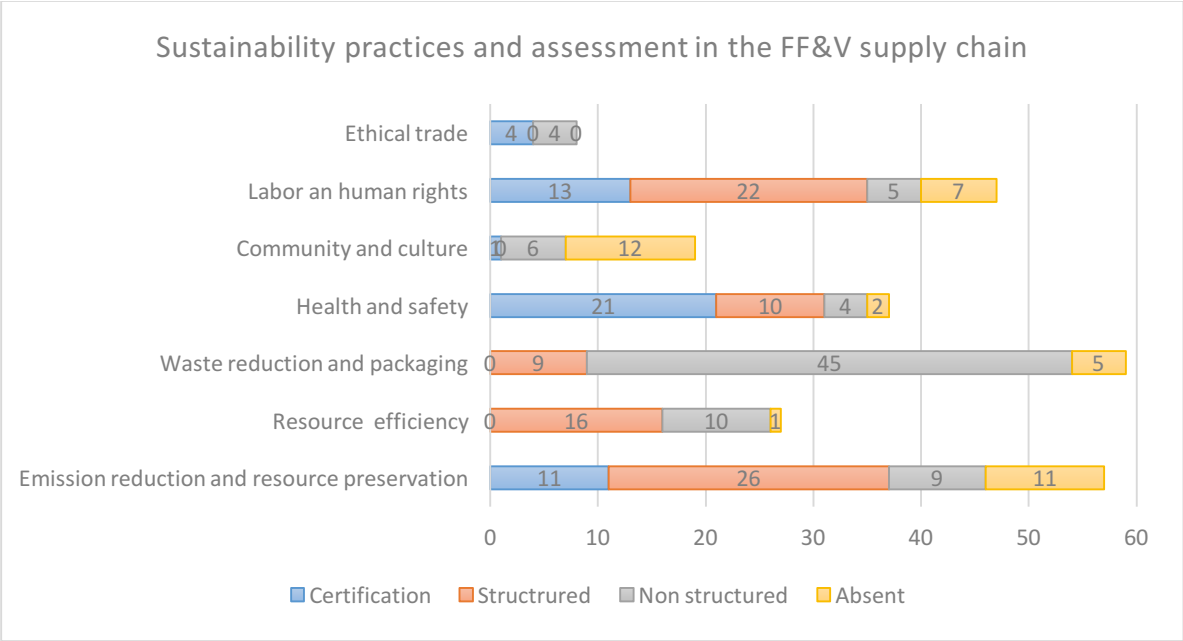

Fig. 4: Sustainability practices and assessment mechanisms in the FF&V supply chain

Characteristics motivating sustainability assessment

Aiming at answering Research Question 2, three company characteristics fostering the adoption of such varied assessment methods were identified during the analysis: company size, assessment complexity and level of vertical integration.

Regarding company size, interviewees explained how smaller companies tend to evaluate less and usually in a non-structured way; e.g., Case C and Case I implement several environmental practices but focus on counting the amount the material consumption for inventory refill, that is, a non-structured assessment. Whereas for larger companies evaluating or monitoring sustainability practices is not different than evaluating other activities, especially since they already have structured assessment systems or certification schemes implemented. For instance, Case J assesses almost all its practices with a structured method via its own yearly sustainability report or by adhering to certifications for animal welfare, traceability and transparency.

Second, companies explained that different assessment is applied depending on the complexity of the measures or mechanisms. Several interviewees explained that when they evaluate or monitor their sustainability practices is usually because this assessment does not interfere with daily operations or when the practice is already assessed for any other purpose like reporting to customers. Contrarily, if the assessment requires larger investments in terms of people, IT systems, or any additional cost, then the practice is usually not assessed. For example, Case D monitors packaging waste for optimizing its processes and that information is useful to evaluate waste generation. However, company D does not assess the use of a low emission truck as it requires specific IT systems to monitor the emissions.

Third, the sustainability assessment also depends on the level of vertical integration. Assessment (structured or certification) was observed more frequently in the companies with a higher level of vertical integration as they expand the data collection and processing for different practices more efficiently along their operations. For instance, Case E evaluates its

"Resource Efficiency" practices through its own measurement system in a structured manner, and adhered to the BRC and IFS certifications for their "Health and Safety" practices. Similarly, Case B certified its "Labor and Human Rights" practices, and has its own structured performance measurement system for most of the practices implemented.

Discussion

Sustainability assessment in the FF&V supply chain

Figure 2 showed a high variety of sustainability practices implemented in the FF&V supply chain. According to the stakeholder theory and as summarized by Freeman et al. (2010), such variety or actions taken, explains how companies respond to varied stakeholder pressures. Moreover, as Sarkis et al. (2011) also argued on the base of stakeholder theory, companies implement sustainability practices that do not necessarily bring benefits or competitive advantages but are required because of stakeholder pressures.

Accordingly, this study identified several elements shaping this varied behavior in companies of the FF&V supply chain such as industry characteristics, benefits or competitive advantages expected, company culture, consumer attention. First, the intrinsic characteristics of the fresh food supply chain (e.g., freshness, perishability, quality variation) (Trienekens et al. 2012) make companies particularly devoted to reduce the contamination in the fields, to optimize the use of resources and decrease waste generation, and to prioritize safe food production. Moreover, companies consider these practices to be easier to implement than others, and they could perceive the benefits sooner, for instance reducing emissions in transportation and production, or reducing waste. On the other hand, some practices were case-specific, in cases where the company culture drove sustainability actions like community involvement or reinsertion of displaced or disadvantaged people, as in Case J and Case K. This type of strategy has been identified in literature and in international organizations that increasingly propose social sustainability practices as part of the overall sustainability strategy (Maloni and Brown, 2006; Pullman et al. 2009; ISEAL, 2014; FAO, 2015).

Furthermore, it was observed that practices in particular stages respond to specific objectives, not necessarily related to sustainability performance but in order to achieve competitiveness, increasing revenues as suggested in Pullman et al. (2009) and Varsei et al. (2014), or for responding to stakeholder pressures (Sarkis et al. 2011). An example was the *Grower* stage that is committed to reduction of emissions and resource contamination practices for developing safer and healthier products that consecutively also aim at increasing sales with premium prices. Companies recognized the importance of reducing the contamination for the environment, and it was even more relevant if these practices enable the company to increase market share and revenues. Findings in our study support the expansive implementation of environmental and social sustainability practices in the food supply chain as companies intend to catch the attention of new consumers that value a wider range of sustainability initiatives, from philanthropic to the ones oriented to safer and healthier food as well.

Regarding sustainability assessment, the level of formalization, i.e., definition of measurement criteria, frequency, cost of the measurement, obligations/ responsibilities for each measurement; and integration, i.e., if it is isolated or inputs are shared with other organizations (De Toni and Tonchia, 2001), is varied among the practices implemented and among type of companies. In addition, the assessment method applied in this supply chain is highly heterogeneous and this behavior is rather uniform across stages, that is, there is not a direct dependence between stages and type of assessment applied.

Still in the sustainability assessment topic, the intention in this study was to outline if there is any kind of assessment used in different kinds of companies and in different stages in the FF&V supply chain, and what kind. Given the high complexity in the Italian fruit and vegetables supply chain (i.e. different sizes, locations, products, strategies), the assessment

cannot be taken for granted. Findings supported the argument that companies in this food supply chain apply a more structured (or certification) kind of assessment when the practices are regulated or when a particular product is to be promoted (Marshall et al. 2015; Schmitt et al. 2017, Varsei et al. 2014). In line with Clarkson (1995), it is seen that companies in the FF&V supply chain generating assessment data demonstrate more attention to issues considered more important, e.g., regulations. Hence, this kind of stakeholder pressure justifies to be managed and therefore, evaluated. Otherwise, the assessment is highly varied. Such heterogeneity in the sustainability assessment is consistent with previous literature as well. Authors have mentioned that when the number of sustainability issues covered increases, the complexity of evaluation and verification tends to increase too (Gualandris et al. 2015). Moreover, findings in this study suggest that the sustainability assessment benefits depend on how the practices are evaluated and also depend on certain firm characteristics that need to be identified as well.

Company´s features influencing the application of sustainability assessment

There are three main company´s features that allegedly foster the sustainability assessment in the food supply chain. These characteristics are: company size, assessment complexity and level of vertical integration. In line with Arena and Azzone (2012), this study illustrates that smaller companies face more challenges implementing sustainability reporting or a more structured assessment due to lack of capabilities, resources and/or instruments to support them. On the other hand, consistently with previous studies, in the FF&V supply chain the identification and selection of measures demands efforts that could be overloading the people involved with overly sophisticated or redundant information (Bourne et al. 2002; Genovese et al. 2017). Therefore, companies prefer to focus the evaluation on already existing systems that do not alter daily operations, and thus, sustainability assessment remains unstructured or even absent. Besides, when the issue is not considered crucial to be managed, i.e., the stakeholder pressure is not as important as others, as Clarkson (1995) argued, the company would not generate evaluation data as well. The third feature identified in our case studies, vertical integration, is also in line with Trienekens et al. (2012) and Gualandris et al. (2015), who explained that in vertical organizations the use of standards could be spread, traceability facilitated and the scope of the sustainability evaluation could be increased.

Nonetheless, these factors alone might not be the only ones fostering sustainability assessment and might not influence companies simultaneously. Sustainability assessment expectations from customers (wholesalers, retailers), regulators and other stakeholders have triggered the search for support in order to better manage those pressures considered more important than others, or that could be in conflict with others (Sarkis et al. 2011, Freeman et al. 2010, Clarkson 1995). The way companies deal with different stakeholder pressures for sustainability and sustainability assessment could be also promoted by external actors. For instance, the role of cooperatives in the FF&V supply chain is determinant for sustainability assessment purposes, especially for *Growers*. Cooperatives usually group a high number of members and product volumes, and facilitates collective investments to implement and assess sustainability. *Growers* in our cases are associated in cooperatives and have been able to implement European food safety sustainability certifications like BRC (British Retail Consortium) Global Standards and IFS Food (previously known as International Food Standard). These international certifications have become mandatory for *Growers* in order to be able to work with the major retailers. Therefore, in order to access the mainstream market, *Growers* are compelled to get the certifications, and cooperatives play a key role for these companies to comply with the expectations and- or regulations Actually, horizontal integration through cooperatives has allowed these *Growers* to obtain the production scale to meet the main customer´s requirements. Contrarily, Case A that is not a member of any cooperative, doesn't have these certifications since it doesn't have the financial means to invest on them.

For better dealing with stakeholder pressures firms should generate evaluation data (Clarkson, 1995) that help them to attain benefits expected from their sustainability efforts. Accordingly, companies in the FF&V supply chain need to set up sustainability practices and assessment mechanisms that are in line with their size, capabilities and with their own complexity determined by the level of vertical integration. External actors as cooperatives could assist to develop capabilities and improve such sustainability assessment objectives.

Conclusions

The aims of this study were to understand how companies in the FF&V supply chain assess their sustainability practices if they do, and to identify the factors contributing to the application of sustainability assessment. Firstly, we identify the type of sustainability practices implemented in different stages of the FF&V supply chain, and then describe if they were assessed and how. Finally, the main elements influencing the use of sustainability assessment are identified. The study is grounded on stakeholder theory that helps the findings description and interpretation considering how companies deal with pressures to act and evaluate sustainability. We analyzed 12 companies with operations in four different supply chain stages: *Growers*, *Processors*, *Wholesalers*, and *Retailers*.

The companies studied mostly implement practices related to "Emissions reduction and resource preservation", "Waste reduction and packaging" and "Health and safety". From the total of practices implemented, approximately half of them were either not assessed or assessed in a non-structured way, therefore, this highlights a major issue to be addressed, since a non-assessed practice implies either a missed opportunity, or even a mislead effort. Regarding assessment, a variety of methods is applied depending on the type of practices implemented, e.g., the "Emissions reduction and Resource preservation" practices, are assessed with all methods; "Health and Safety" are mostly certified or evaluated with structured mechanisms; "Waste reduction and Packaging" are either not assessed or assessed in a non-structured way. Finally, we identified three main factors that motivate companies to assess their sustainability practices: company size, complexity of measurement, and level of vertical integration.

In terms of theoretical implications, studies that consider sustainability performance evaluation and management beyond the metrics definition are lacking. As Bourne et al. (2000), Genovese et al. (2017) and Gualandris et al. (2015) argued, companies struggle with metrics implementation and information use, especially when multiple objectives are considered and multiple stakeholders are involved. Trade-offs would need to be managed when conflicting stakeholder pressures exist (Freeman et al. 2010) and thus, companies would require to find the appropriate way to deal with those pressures while getting benefits form their sustainability efforts (Sarkis et al. 2011). In this regard, and in line with Clarkson (1995) and Freeman et al. (2010), sustainability assessment would provide the data reflecting the management of stakeholder´s pressures. If such data is collected and analyzed, then, companies would be able to determine if their sustainability efforts are worth. However, not all firms are capable to deploy such assessment for different reasons, or are partially doing it in response to what they consider to be most *important* pressures. This study analyzes the use of sustainability assessment in different types of companies in different stages of the FF&V supply chain, and identifies the characteristics influencing the use of sustainability assessment. Sustainability assessment is found to be varied, thus confirming that no standard or unique system is applied in this supply chain, and our findings support the idea of the assessment being dependent on the type of practices implemented, the type of company and supply chain; the complexity of the assessment mechanisms; and, different levels of vertical integration.

This study could be also of practitioners´ interest by identifying the assessment mechanisms implemented for different kind of sustainability practices, and the factors that foster sustainability assessment. These could be useful for setting up better sustainability assessments

along the FF&V supply chain, according to companies' individual capabilities and objectives, supporting a more effective sustainability strategy and stakeholder management along the chain.

Future research opportunities could emerge from the findings in this study. The analysis here was concentrated in a specific type of food supply chain in a particular geography, thus, it could be interesting to validate the results in a supply chain dealing with products with longer shelf-life or with products that are exported/imported to/from other countries. In addition, studies could address the feasibility of designing an ad-hoc sustainability assessment system that covers multiple dimensions simultaneously, and is also easy to use and interpret.

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Appendix A: Interview Protocol

Company profile

- Company history, business sector, main operations, main products.
- Supply chain description: suppliers, customers.
- Sustainability related strategy: role, responsible, activities (if there are)

Sustainability implementation

- Please detail the type of practices implemented in every operation: category, individual practice, how is it implemented, collaboration, third party involved (if it is the case)

a) Emission reduction and resource preservation
Practices in every operation to reduce emissions and the use of pollutant chemical substances, e.g. responsible farming methods (reducing fertilizer and pesticides), elimination of contaminant and pollutant agents, reducing CO2 emissions and GHGs.

b) Resource efficiency
Reducing water consumption, efficient water use, waste water re-use and recovery. Reducing energy use, energy conservation, reducing the use of other input materials, reducing fuel consumption, and optimization of transportation and logistics processes.

c) Waste reduction and packaging
Reducing food or packaging material waste in the production, packing, transportation and storing processes. Decreasing and/or eliminating hazardous materials, composting organic waste, producing renewable energy or animal feed with food waste, food and material recycling. Packaging reuse and recycling, reducing packaging, using reusable/ recyclable packaging, sustainable packaging design (e.g., for longer food preservation).

d) Health and Safety
Ensuring and increasing consumer's health and safety through product quality and control, reducing contamination risk (food safety and security), traceability, promotion of healthier products and diets, communication and education to consumers.

e) Labor and Human Rights
Improving and guaranteeing good working conditions and enhance workers' wellbeing: regular employment, training, education, respect of worker rights, safe working environment, fair compensation. These practices can be either regulated or voluntary.

f) Community
Supporting local communities, philanthropic initiatives, contributions to improve quality of life in the community, educational projects, health campaigns, promote gender equality and diversity, respect local biodiversity.

g) Ethical trade
Promoting and applying ethical practices and transparency between buyers and suppliers, to improve the quality of life thanks to a premium price for sustainable-grown products, respect and fairness. Certification schemes related.

Sustainability assessment

- Are the practices (refer to every practice implemented) assessed in any way? If yes, How? If not, why not?
- Is it possible to determine the benefits or advantages of implementing the sustainability practices? How? (Certification, method, measure, indicator)
- Is there a performance measurement system regarding sustainability? Does the company create a report to communicate the sustainability results?

Working capital models in manufacturing value chains: Towards a generic framework

Lotta Lind, Timo Kärri, Veli Matti Virolainen, Sari Monto
LUT School of Business and Management, Skinnarilankatu 34, 53850 Lappeenranta, Finland
e-mail: lotta.m.lind@gmail.com; timo.karri@lut.fi; veli.matti.virolainen@lut.fi; sari.h.monto@gmail.com
Phone: +358503098181; +358503223320; +358405411862; +358407317673

Summary
This paper concerns the working capital models of companies in manufacturing value chains. The objective is to identify working capital models and working capital positions in the value chains. The empirical financial data from 100 companies were analyzed systematically with the financial value chain analysis method. The findings indicate that similar working capital models are applied in the value chains of the automotive and pulp and paper industries but with different emphases. Based on the empirical findings, a framework for working capital models is proposed, and it introduces six different working capital models applied in the manufacturing value chains.
Key words: working capital, financial supply chain
Submission category: competitive paper

Introduction

Working capital is an asset keeping the operations of the firm running. Rapid changes in business and challenging financial conditions have increased the interest towards efficient asset management (Mullins, 2009). In the value chain context, working capital links the material and financial flows: it is an investment in inventories, and balancing between financial flows upstream and downstream. Farris and Hutchison (2003) note that instead of focusing on individually managing each working capital component, companies should define their unique combinations of all components of operational working capital: inventories, accounts receivable, and accounts payable. It has also been shown that the most efficient way to improve the profitability of the value chain by working capital management in the value chain of the automotive industry is to manage all components simultaneously (Viskari et al., 2012), but this kind of a comprehensive view to working capital management has not been applied by companies (Brandenburg, 2016). Thus, research on working capital models is highly relevant and needed.

While studies on finance have traditionally concentrated on trade credit issues, operations management has focused more on the management of inventories. The emergence of the research stream of financial supply chain management (FSCM) has brought the value chain perspective and collaborative working capital management into discussion (e.g. Randall and Farris, 2009; Hofmann and Kotzab, 2010; Protopappa-Sieke and Seifert 2017), and hence, combined the financial issues with the management of supply chains. Still, only a few studies on working capital management take into account the holistic view on working capital consisting of both the material (inventories) and financial (trade credit) flows. The concept of working capital models calls together the fragmented academic literature of working capital management from two research streams. However, prior research on working capital models is scarce. The studies have mainly concentrated on different working capital practices and used survey data (e.g. Belt and Smith, 1991; Ricci and

Morrison, 1996; Howorth and Westhead, 2003). The literature lacks studies based on numerical financial data, which reveal the realized working capital models companies have applied.

Today, companies operate in a networked environment and competition occurs between inter-organizational value chains. The perspective of a single company, and praising the superiority of the strategy aiming at minimizing working capital by using power at the expense of value chain partners are perspectives too narrow in the current business environment. For example, the studies have shown that payment term adjustments towards suppliers provide short-term benefits by improving immediate liquidity, but on the long-term may have a negative impact on the firm (Kroes and Manikas, 2014; Huff and Rogers, 2015; Grosse-Ruyken, Wagner, and Jönke, 2011; Wandfluch, Hofmann and Schoensleben, 2016). Several researchers have highlighted the need for collaborative working capital management (e.g. Hutchison, Farris and Fleischman, 2009; Gomm, 2010; Vázquez, Sartal and Lozano-Lozano, 2016). FSCM aims at the optimization of working capital at the value chain level. Companies in the value chain should have different kinds of working capital strategies depending on their position in the chain, as all companies do not benefit from similar working capital actions (Viskari et al., 2012). However, all firms should ensure that their working capital decisions are in line with the structure of the value chain (Grosse-Ruyken, Wagner and Jönke, 2011), and Wuttke, Blume and Henke (2013) also highlight the importance of understanding the positions in the value chain.

The objective of this paper is to explore different working capital models applied by companies and the companies' working capital positions against each other in two manufacturing value chains representing the automotive and pulp and paper (P&P) industries. The study aims at adding to the understanding of realized working capital models in the value chains, as well as at providing a framework for positioning and categorizing the value chain actors on the basis of their working capital models. This will enhance the awareness of the working capital environment of the value chain. The answers to the following research questions are sought after: *Which working capital models can be identified in the manufacturing value chains? Can we find patterns in working capital management between the value chains in different industries?*

Literature review

FSCM has been one of the most interesting research streams in supply management and as well as in management accounting, but the robust theoretical background has been missing. This study applies the theories of transaction cost theory (TCE), the finance, and inventory management to FSCM phenomenon. Taking care of the allocational efficiency of capital markets, and ensuring that the resources are allocated to where they are most productive, is essential due to the limited amount of resources (Arnold 1998). This serves as the theoretical foundation of this paper. In recent years, the concept of FSCM has gained more attention in academia, and brought the flow of money and financial aspects into the discussion on supply chains (Protopappa-Sieke and Seifert 2010). Wuttke et al. (2013) defined the purpose of FSCM as "optimized planning, managing, and controlling supply chain cash flows to facilitate efficient supply chain material flows". In other words, as a combination of these two perspectives, financial resources should be allocated for more productive objectives in the supply chains. This calls for the reduction of working capital

to a reasonable minimum in the supply chains, but also for the optimization of working capital within the supply chains.

The management of operational working capital consists of the management of inventories, accounts receivable and accounts payable. In this paper, we take a holistic perspective on working capital by focusing on the unique combinations of all working capital components (Farris and Hutchison, 2003), i.e. working capital models. Traditionally, research on working capital management was separated into two fields: the literature of finance studied trade credit, and supply chain management literature focused on inventory management. The concept of a working capital model brings these streams together. Trade credit is a common practice between companies. It is created when a buyer delays a payment for purchased goods according to the agreed payment terms between the companies. The motives for the use of trade credit vary: suppliers may offer trade credit due to competitive pressure, and buyers demand it in order to pool payments, reduce cash balances, and to replace bank loans (Seifert and Seifert, 2008). Studies on trade credit have concerned e.g. credit risk models, trade credit motives and credit term decisions (Seifert, Seifert, and Protopappa-Sieke 2013). The reduction of accounts receivable has been found to be positively associated with firm performance, but the accounts payable were not linked with performance (Kroes and Manikas, 2014). The study highlighted that the increase of accounts payable only improves immediate liquidity, but on the long-term may have a negative impact on the firm. Similar statements were presented by Grosse-Ruyken et al. (2011) and Wandfluch et al. (2016), as well as by Huff and Rogers (2015), but they noted that advantages gained by improving inventory management are longer-lasting. This is in line with the conclusion that the sustainable reduction of working capital should be done via effective management of inventories as payment term adjustments offset each other in the supply chain context (Lind et al., 2012).

Inventory management research has concentrated on efficient operations and the correct sizing of inventory in relation to economic order quantity (EOQ), management philosophies like just-in-time (JIT) and lean, and issues in demand characteristics and marketing environment (Koumanakos 2008). Inventory management involves the control of assets produced to be sold in the normal course of a firm's operations. The general categories of inventory include the inventories of raw materials, work-in-process, and finished-goods. The importance of inventory management to the firm depends on the extent of its inventory investment. Inventories can be seen as tied up capital, as a more or less intended investment, which should be aimed at achieving solutions as economical as possible. Managing inventories involve a lack of funds and inventory holding costs. The maintenance of inventory is expensive, so why should firms hold inventories? Keynes (1936) differentiated three motives for holding money/cash: 1) the transaction motive, 2) the precautionary motive, and 3) the speculative motive. These can also be applied to inventory problems, and they are motives to be distinguished in most used classifications (e.g Arrow et al., 1958):

1. *The transaction motive* propels a business to maintain inventories so that there are no bottlenecks in production and sales. It is natural for a business to plan inventory investments commensurate with the level of transactions in the business.

2. *The precautionary inventory management motive* necessitates the holding of inventories for unexpected changes in demand and supply factors.
3. *The speculative inventory management motive* compels to hold some inventories to take advantage of changes in prices and getting quantity discounts.

The purpose of carrying inventories is to uncouple the operations of the firm – that is, to make each function of the business independent of other functions – so that delays or shutdowns in one area do not affect the production and sale of the final product. Decision-making about inventory levels involves a basic trade-off between risk and return. The risk is that if the level of inventory is too low, the various functions of business do not operate independently, and delays in product and customer delivery can ensue. But a lower level of inventory can also save the firm money and increase returns. Moreover, as the size of inventory increases, storage and handling costs as well as the required return on capital invested in the inventory rise. In short, as the inventory a firm holds is increased, the risk of running out of inventory is lessened, but inventory expenses rise.

It is also worthwhile to mention cash (i.e. cash and cash equivalents consisting of excess cash and cash needed for daily operations) in the light of inventory management. This is because the stock of cash carried by a firm is simply a special type of inventory. In terms of uncoupling the various operations of the firm, the purpose of holding a stock of cash is to make the payment of bills independent of the collection of accounts due. When cash is kept on hand, bills can be paid without prior collection of accounts. Bianco and Gamba (2017) show that inventory and cash holdings are synergic tools: while the first is a valuable operational hedge against the commodity price risk, the second enhances the hedge offered by inventory in the face of costly external finance.

In today's networked environment and competition between inter-organizational value chains, the perspective of a single company on working capital is rather narrow. FSCM emphasizes efficient working capital management throughout the value chain, and researchers suggest companies to take a supply chain approach to working capital to ensure the supply chain profits as a whole (Hutchison et al., 2009; Hofmann and Kotzab, 2010). However, studies have found that in practice, instead of collaboration, companies move harms in terms of inventories and/or trade credit along the value chains (Vázquez et al., 2016; Lorentz et al., 2016). In the value chain context, it should be considered how working capital should be managed in the different parts of the chain as all companies cannot reduce their working capital close to zero without affecting other companies. Each firm should ensure that their cycle time of working capital is in line with the structure of the value chain (Grosse-Ruyken et al., 2011), and firms should understand their position in the supply chain before making decisions related to FSCM (Wuttke et al., 2013). It has been found that the relation between working capital management and profitability differs in different parts of the value chain, which suggests that companies have and should have different strategies in working capital management depending on their position in the chain (Viskari et al., 2012). Previous literature on working capital management lacks the research on these different patterns of managing working capital. This study aims at narrowing down this gap by identifying working capital models existing at the value chain level.

Research process and design

Description of the value chains

Two industries were selected to demonstrate the current state of working capital management in manufacturing value chains. The automotive and P&P industries were chosen as capital-intensive representatives of traditional manufacturing industries, where certain amounts of working capital are needed to ensure the fluent flow of production. They represent different types of production: the automotive industry is an example of batch and serial production, and the P&P industry represents process industry. As a forerunner of lean management, the automotive industry has a strong orientation towards efficient working capital management, and the importance of working capital has been highlighted by companies such as BMW (2010) and Valeo (2014). Working capital management in the automotive industry has also been studied by other researchers (e.g. Brandenburg 2016; Vázquez et al., 2016). In the P&P industry, the return on capital employed is very sensitive to the amount of capital tied in the inventories of raw materials and finished products, which has made companies focus more and more on reducing working capital (Carlsson and Rönnqvist, 2005). The structures of the value chains and the total samples can be seen in Appendix 1, and they follow the approach by Lind et al. (2012) and Pirttilä et al. (2014).

Data and measures

The empirical data of this study consists of financial figures gathered from the official consolidated financial statements of the years 2006–2010. Moers (2007) has criticized the archival data approach due to the uncritical usage of databases. In this study, we tackled the problem by collecting the financial statements only from public sources, which were mainly company websites, and collected and calculated the financial figures manually. This ensures the correctness and traceability of the used figures.

In this study, working capital models are measured with cycle times. The cycle time approach has been used in several studies regarding working capital management (e.g. Farris and Hutchison, 2003; Hofmann and Kotzab, 2010; Grosse-Ruyken et al., 2011; Pirttilä et al., 2014). Table 1 introduces the used measures and the determinants of the working capital model.

Table 1. The definitions of used determinants and measures.

Variable	*Component*	*Definition*
DIO	Cycle time of inventories	DIO = (Inventories/Sales)*365
DSO	Cycle time of accounts receivable	DSO = (Accounts receivable/Sales)*365
DPO	Cycle time of accounts payable	DPO = (Accounts payable/Sales)*365
DSO-DPO	Net trade credit	
CCC	Cycle time of working capital	CCC = DIO + DSO - DPO
ROC%	Return of capital employed	ROC% = EBIT/((Equity$_t$+Equity$_{t-1}$)+ (Long term liabilities$_t$+Long term liabilities$_{t-1}$))/2

The values for inventories (including raw material, work-in-progress, and finished goods), accounts receivable and accounts payable were collected from balance sheets. The cycle times are calculated as a proportion of sales (Shin and Soenen, 1998; Lind et al., 2012), and the value of sales was picked from income statements. In this study, the working capital models have been determined by the DIO and DSO-DPO, which is considered as the balance between trade credit components. Together the components constitute the cycle time of working capital, i.e. cash conversion cycle (CCC). The variable DSO-DPO (also

called net trade credit), combines the components of financial flow and describes the balance between them. The variable has been used as a measure in previous research as well (Nadiri, 1969; Lorentz et al., 2016).

The results of the study show the companies' average figures from 2006–2010. This approach was chosen in order to analyze a company's long term working capital management and eliminate the yearly fluctuation in performance. Due to the unavailability of data, some firm-year observations are missing (see Appendix 1). In these cases, the company averages were calculated with the figures of the available years. Table 2 provides descriptive data on the sample.

Table 2. Descriptive data on the research sample.

	Number of		CCC (days)			DIO (days)			DSO (days)			DPO (days)			DSO-DPO (days)		
Industry	Companies	Stages	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
Automotive	55	6	70	8	146	49	11	98	55	13	141	34	7	71	20	-21	97
Pulp and paper	45	8	59	8	110	41	3	85	53	21	100	35	9	78	18	-26	65

Methods

The financial value chain analysis (FVCA) is used as a research method in this study to identify different working capital models applied by companies in the value chains of the automotive and P&P industries. The method was chosen as it provides a systematic process to analyze the financial figures in the value chain and its different stages (Lind et al., 2012). The method has been used previously to analyze the cycle times of working capital at the value chain level in several studies (e.g. Lind et al. 2012; Pirttilä et al. 2014). This empirical study employs an archival research approach (Moers, 2007). The results of the FVCA are analyzed in the WCM matrix (Lind, Monto and Kärri, 2017) described in Figure 1.

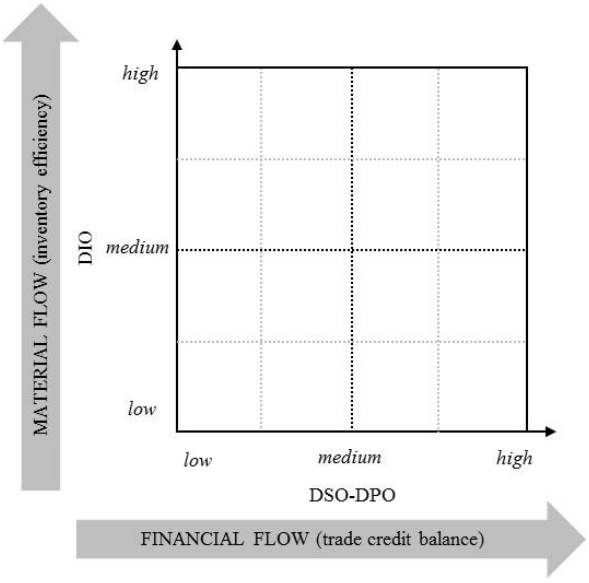

Figure 1. WCM matrix (adapted from Lind et al., 2017).

The WCM matrix approach was chosen as the it enables the analysis of different working capital models, combining the two flows of working capital, in the same figure. This kind

of a holistic view to the working capital of companies is emphasized by several researchers (e.g. Farris and Hutchison, 2003; Viskari et al., 2012; Brandenburg, 2016). In addition, the WCM matrix enables the analysis of the working capital positions of the companies against each other in the value chain, the definition of the working capital models applied, and a comparison of working capital models in the different value chains. The vertical axis of the matrix describes the efficiency of inventory management (DIO), whereas the horizontal axis presents the net trade credit (DSO-DPO). In this paper, we have divided the WCM matrix into 16 working capital models. This was done by dividing both axes equally into four parts between the minimum and maximum values of the samples. Hence, the border values for the working capital models are different in the automotive and P&P industries.

Limitations

The data from financial statements represent the situation on one day of the fiscal year. During the year, seasonal factors may cause remarkable changes in working capital and make it differ from the year-end figures. The use of monthly data instead of annual figures would enable the observation of differences in working capital during the year. However, obtaining monthly data reliably or from public sources at this scale is difficult. Therefore we rely on the annual figures from official sources. The figures from annual reports are suggestive enough for the purposes of our analysis, but the authors advise to keep this feature of the used data in mind.

Empirical results

The analysis of the results is conducted by positioning the companies on the basis of their DIO and DSO-DPO in a WCM matrix. The WCM matrix scatter charts (Appendix 2) show the average value of the years 2006–2010 for each company, and the companies are grouped by the stages. Additionally, the average working capital models of the stages are presented in the charts. The sample has been organized into 16 different working capital models.

The shortest cycle times of working capital can be achieved by applying a working capital model in which both the DIO and DSO-DPO are low, or in which slightly higher inventory levels are compensated with particularly efficient management of financial flows, and vice versa. In the WCM matrix, these models are located in the bottom left corner. The results showed that the most companies in the extreme stages of the value chain of the automotive industry, i.e. raw material suppliers and car dealers, were applying this type of working capital model. In the P&P value chain less companies were located in this part of the matrix. The companies applying the most efficient working capital model were mainly brand owners and publishers representing the downstream part of the value chain.

The scatter chart (Appendix 2) shows the peculiarity of the business model applied by car manufacturers. The long DSO caused by the financing and leasing services car manufacturers offer to their customers (Lind et al., 2012) has led to the great difference between the DSO and DPO in all companies within the stage. Thus, they can be seen operating as financiers in the value chain. However, car manufacturers differ from each other in the management of inventories. In the P&P industry, the stages differ from each other in inventory management. The stages of market pulp, chemicals, and machinery act as inventory holders in the value chain, whereas publishers, printers and brand owners have low inventory levels. This follows the structure of the value chain: the upstream part of the

chain ties up more working capital in the inventories than the downstream part. However, the companies within the stages of the P&P value chain have different practices related to trade credit management.

In both value chains, the companies within the several stages seem to be located close to each other in the WCM matrix. In other words, many companies seem to follow the same or similar working capital models with their competitors. For example in the automotive industry, car dealers and raw material suppliers focus on minimizing their working capital, and refined raw material suppliers operate as inventory holders, whereas the working capital model by printers in the P&P industry is characterized by low inventories and higher net trade credit. However, opposite behavior was identified as well. For example, component suppliers in the automotive industry and chemical and machinery suppliers in the P&P industry applied several very different working capital models.

Figure 2 shows the division of the sample companies into different categories of the WCM matrix. In this figure, the value chain of the automotive industry (referred to as "A" in Figure 3) and P&P industry ("P") are shown together, but it should be noted that the border values of the categories were different in the value chains due to the different minimum and maximum values of these two separate samples.

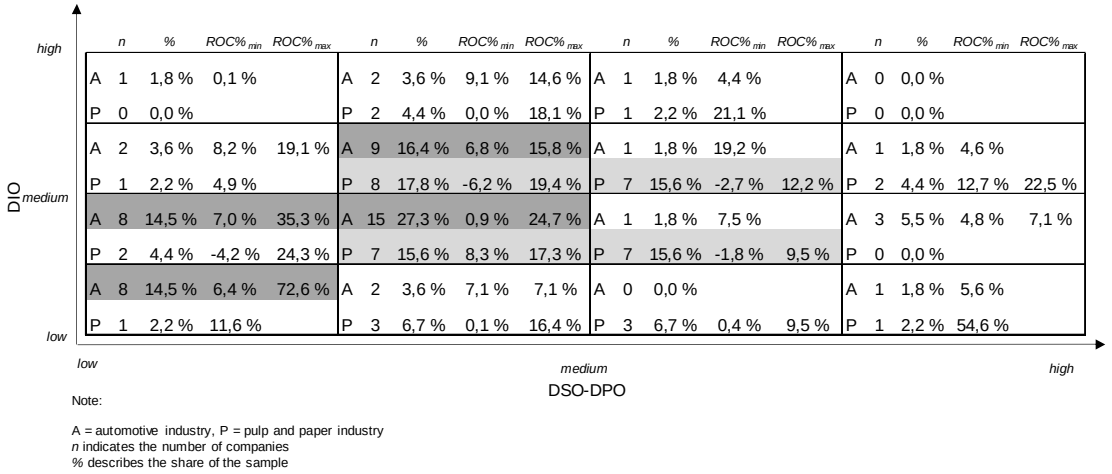

Figure 2. The division of the working capital models in the value chains.

As shown by Figure 2, the four most popular working capital models can be explicitly identified in both value chains (colored with grey in the figure). Other models were only applied by 1–3 companies. However, the value chains differ in their emphasis of working capital models. The automotive industry seems to aim more strongly at minimum working capital, whereas the most popular working capital models in the pulp and paper industry are formed around the medium values. Figure 3 also shows the range of the ROC% of the companies within the working capital models. Due to the relatively small sample size, the results are mainly descriptive and explicit conclusions cannot be drawn.

In the value chain of the automotive industry, the most popular working capital model with fifteen companies is the model directly below the medium borders of the matrix. This indicates that the companies may aim at minimum working capital, but for one reason or

another, room for improvement in the management of material as well as financial flows still remain. Three other popular working capital models are applied by 8–9 companies. One of these working capital models is directly above the previous one, and hence differs by having higher inventory levels. The other two most applied working capital models are the one with minimum working capital, and the one that focuses on low net trade credit, but keeps slightly higher inventory levels than the minimizers. In the P&P industry, the working capital models in the middle of the matrix are the most popular. Companies are equally divided into these four models, which can be described as inventory focused working capital model (8 companies), financing focused working capital model with lower inventory levels (7 companies), financing focused working capital model with higher inventory levels (7 companies), and working capital model aiming at short cycle times (7 companies).

Framework for working capital models in a manufacturing value chain

The analysis shows that companies within the value chains have different mixes of inventory and trade credit management, i.e. working capital models. Some similar patterns are found in the studied value chains, but with different focuses. On the basis of this analysis, general working capital models in the manufacturing value chain can be identified. Figure 3 concludes the findings in a preliminary framework for working capital models.

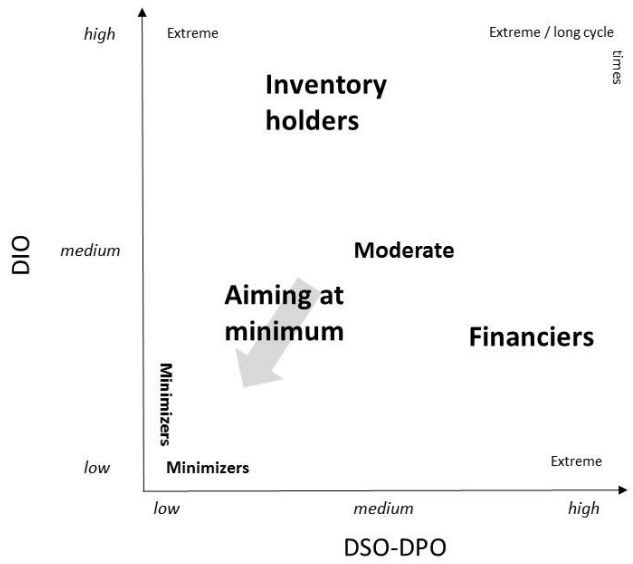

Figure 3. Preliminary framework for working capital models.

Both value chains emphasized the working capital model that *holds inventories*, as well as the model that seems to *aim at minimizing* working capital, but still has potential to improve it. In the automotive value chain, *minimizers* were identified, whereas in the P&P industry, companies focused on the medium levels of working capital by applying the *moderate* working capital model. *Financiers* were found in both value chains, but it characterized the value chain of the automotive industry even more. The *extreme* working capital models, containing the working capital models with the *longest cycle times*, were applied only

occasionally. The size of the text illustrates the incidence of working capital models in the studied value chains.

Discussion and conclusions

The analysis of working capital models in the WCM matrix revealed that, in the value chain of the automotive industry, working capital is managed in a relatively efficient manner, as the majority of the companies had minimized, or they aimed at minimizing, their working capital. The extreme working capital models were applied only occasionally. This indicates that the working capital efficiency of the total value chain could be improved by supporting the companies with weaker working capital management. This could be done e.g. by payment term adjustments as a compensation for holding inventories, or by providing opportunities for reverse factoring. On the other hand, it could be discussed what kind of collaborative actions could be done in order to reduce the inventory levels of these companies. The analysis of the value chain of the P&P industry, in turn, showed that companies were positioned in the middle of the WCM matrix. This indicates that not all potential to release working capital from the value chain has been utilized. Actions to improve working capital management throughout the value chain could benefit all actors and make the value chain more effective.

Theoretical and Managerial Implications

The financial value chain analysis applied in this study enables the identification of different working capital models. A generic framework for working capital models in the manufacturing value chain context, based on our empirical findings, offers a holistic view on working capital management, and introduces six working capital models: Inventory holders, Aiming at minimum, Financiers, Moderate, Extreme (including the longest cycle times) and Minimizers. The framework enables the analysis of working capital models at the company and value chain level, but it can also be used to analyze different value chains. As a relatively new research area, FSCM has lacked general frameworks and systematic theory development studies (Gelsomino et al., 2016; Singh and Kumar 2014). This paper is an initiative towards theory development of working capital models targeted at strengthening the basis of FSCM literature with a holistic view on working capital. The study provides new perspectives on the working capital models used by companies by being based on financial data, and considering the value chain perspective.

The paper provides empirical analysis of working capital management in the value chain context. The introduced framework supports collaborative working capital management and the optimization of working capital at the value chain level. The framework can be used as a managerial tool in managing working capital in three ways. *First*, the framework complements the financial value chain analysis (Lind et al., 2012), and helps companies understand the working capital positions in the value chain. *Second*, the framework enables the analysis of working capital models as a combination of all working capital components, which is required when aiming at improvements in working capital management (Farris and Hutchison, 2003). *Third*, the framework supports companies and value chains in defining their targets for working capital management.

Another managerial implication is that firms should recognize their inventories as tied up capital, as an intended investment, which should be aimed at achieving economical

solutions. Managing inventories involve the lack of funds and inventory holding costs but also provide some gains. Inventory and cash holdings are typically considered substitutes in operations and in generating liquidity. In earlier studies it has been implied that inventory and cash holdings can be complementary assets, but the authors would like to highlight the importance of taking into account the broad definition of cash, including not only cash and cash equivalents, but the components of trade credit as well.

Limitations and future research

The presented framework provides a preliminary perspective on working capital models in the value chains. In this study, the value chains only represented manufacturing industries. Further research should attempt to complement and validate the framework with data from different types of value chains, e.g. including service companies. This could raise different issues and working capital models to be considered in the framework. The financial wealth of companies is based on several aspects: growth, profitability, liquidity, and solvency. The concept of a working capital model and the presented framework take a stand on the liquidity positions of the company, but do not reveal the well-being of the company in terms of growth, profitability and solvency. Future studies should find ways to implement these dimensions in the framework as well in order to evaluate the holistic financial positions in the value chain. This information could be further elaborated to determine the most optimal working capital management strategy for the value chain.

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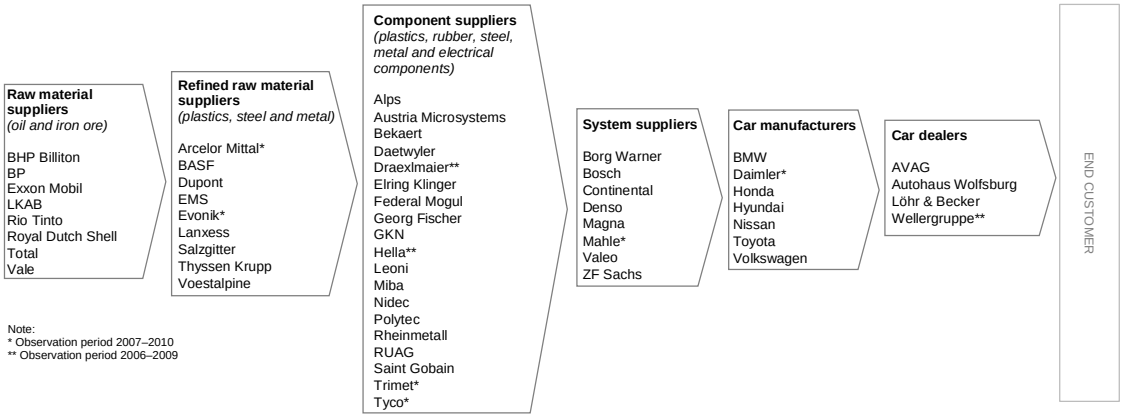
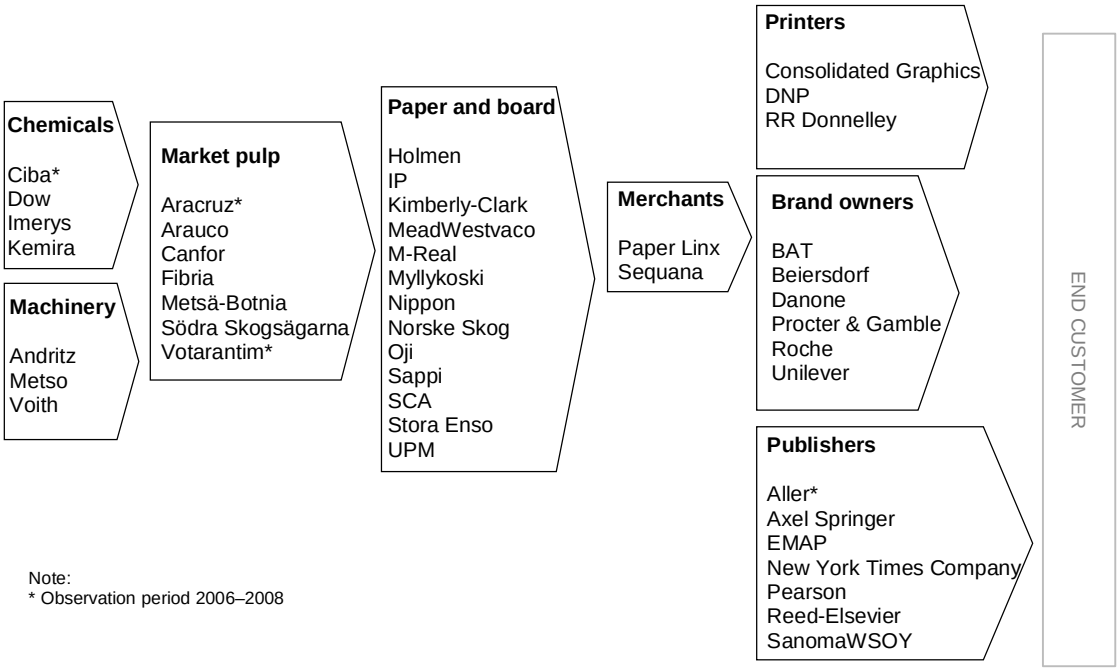
APPENDIX 1. The value chains of the study.

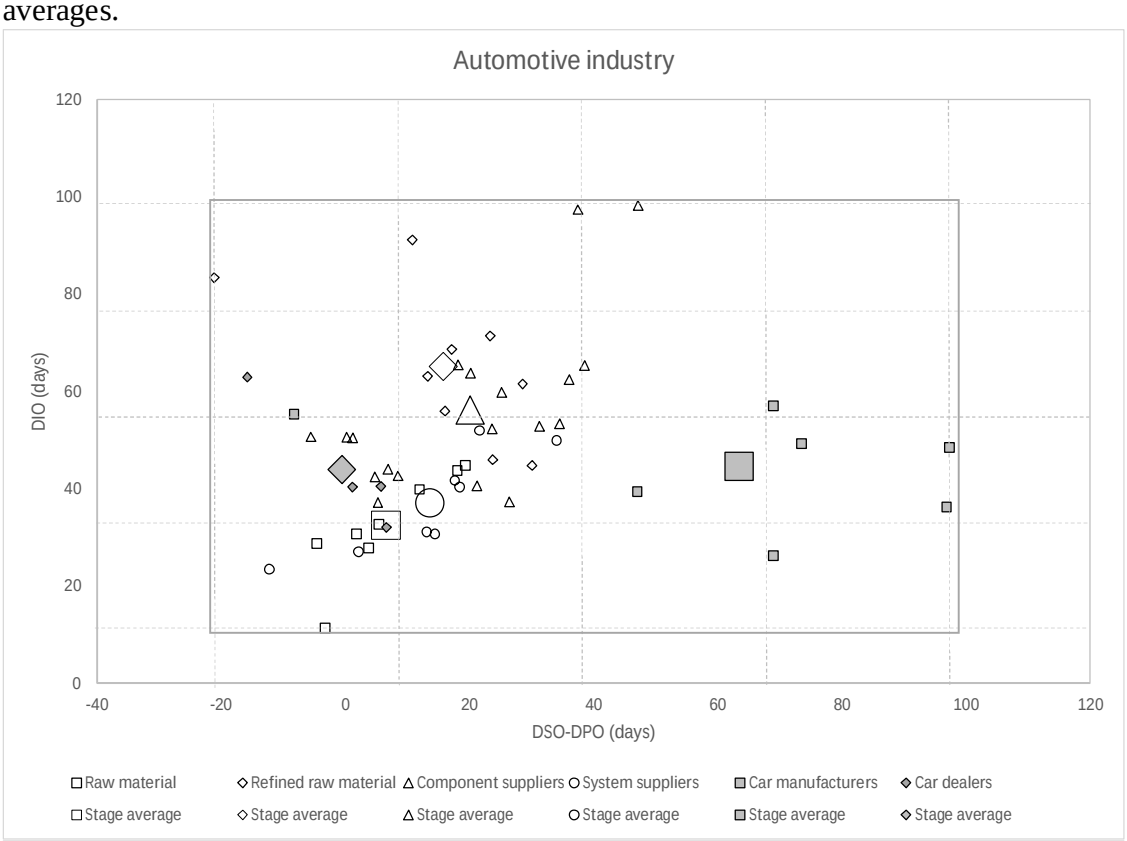
The value chain of the automotive industry

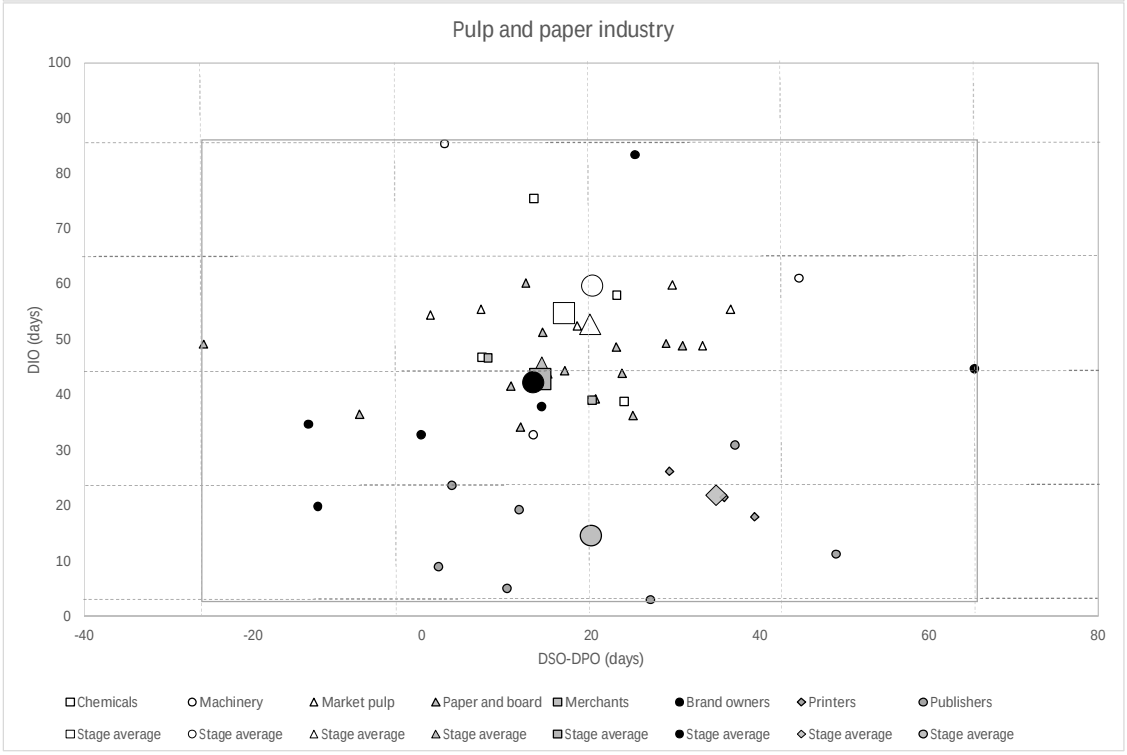


The value chain of the pulp and paper industry



APPENDIX 2. Average working capital models by sample companies and stage averages.





Note: Large markers illustrate the average working capital models of the stages.

Company view to working capital management – empirical research in the forest industry

Lotta Lind and Sari Monto
Lappeenranta University of Technology
LUT School of Business and Management
P.O. Box 20, 53851 Lappeenranta, Finland

E-mail: lotta.lind@lut.fi, phone: +358503098181
E-mail: sari.h.monto@gmail.com, phone: +35840731767

Summary

This paper studies working capital management in paper and board companies. The paper combines the financial analysis of working capital components and case study approach. The case company, Stora Enso, has been able to reduce its working capital by systematical strategic management through the organization, but working capital issues are still considered case by case. The financial figures show that the most effective action in reducing working capital in the past years has been factoring. The reduction of working capital has also been related to the structural changes and savings programs in the forest industry. Trust and transparency are the biggest challenges in moving towards collaborative working capital management at the value chain level.

Keywords: Working capital management, Forest industry, Financial supply chain management
Submission category: Working paper

Introduction

The forest industry has faced challenges during the current millennium. The financial crisis in 2008 hit the industry and caused difficulties for the companies, and digitalization and decreased paper demand has led to remarkable structural changes in the industry. Cutting down paper production and the introduction of new products related to construction, furnishing, bio energy and renewable materials have given an upturn for the field. This paper concerns operational working capital management in the forest industry. The forest industry is characterized by its capital-intensive nature, and thus, broad interest is directed to the management of long-term assets. However, previous studies have shown that the industry also ties up short-term assets and has potential to release working capital from the operations of the value chain (Pirttilä et al., 2014), which would have a positive effect on relative profitability (Viskari, Pirttilä and Kärri, 2011).

Recently, many studies regarding working capital management have highlighted the need for collaborative working capital management in the value chain (e.g. Hofmann and Kotzab, 2010; Grosse-Ruyken, Wagner and Jönke, 2011; Huff and Rogers, 2015) and proposed tools and models to support this target (e.g. Protopapppa-Sieke and Seifert, 2010; Viskari and Kärri, 2012; Wuttke et al., 2016). However, the practical challenges of working capital management inside a company have not been discussed widely – let alone the value chain and the collaborative perspective. The objective of the study is to analyze working capital management in the paper and board companies, and to gain understanding of the current state and challenges regarding intra- and inter-organizational working capital management in the focal stage of the forest industry value chain. The research questions of the paper are: How have the paper and board companies managed their working capital in the years 2013–2016? How does an

individual company see their working capital management and possibilities for collaboration in the value chain?

Literature Review

Working capital management concerns several functions within a company. Consisting of the management of inventories, accounts receivable and accounts payable, working capital management bridges inbound material activities with suppliers, production operations within a company, and outbound sales activities with customers (Farris and Hutchison 2003). Thus, within a company it is affected by the decisions made by several functions, such as production, finance, purchasing and sales. Traditionally, companies have aimed at reducing their working capital to a minimum, as it has been found to increase profitability (e.g. Deloof 2003; Enqvist, Graham and Nikkinen, 2014; Singh, Kumar and Colombage, 2017) and decrease financing costs (de Almeida and Eid Jr., 2014). However, recent studies have suggested that instead of aiming at minimum working capital, companies should find their optimal level of working capital, which maximizes their profitability. The results of the studies have shown that moving away from the optimal level by releasing or tying up more working capital deteriorates profitability. (Baños-Caballero, García-Teruel and Martínez-Solano, 2012; Aktas, Croci and Petmezar, 2015; Pais and Gama 2015)

During the last decade, research on working capital management has increased. Several studies have taken the supply chain perspective to working capital in order to ensure fluent financial flows through the chain (e.g. Hofmann and Kotzab 2010; Wuttke et al., 2013; Huff and Rogers 2015). In this emerging research field of financial supply chain management, studies have separated into two, slightly different areas, i.e. finance and supply chain oriented views (Gelsomino et al. 2016). Whereas the latter one focuses on collaboration in working capital management among the supply chain actors, the finance oriented view focuses on the financial solutions provided by external financial institutions. These solutions include e.g. dynamic discounting, factoring, and reverse factoring (Polak, Sirpal and Hamdan, 2012), of which the latter has gained the most interest among the supply chain finance researchers, and is even used as a synonym for supply chain finance (Grüter and Wuttke 2017). While traditional factoring is based on a firm independently selling their accounts receivable to a factor for immediate cash reception (Klapper 2006) and reducing the tied-up working capital of a firm by shortening the cycle time of accounts receivable, reverse factoring is initiated by the buying company to provide the supplier access to cash on buyers' credit rating while the buyer is able to extend its cycle time of accounts payable (Grüter and Wuttke 2017). The benefit of reverse factoring is the ability to reduce the cost of trade credit, and it is typically considered a win-win situation (Iacono, Reindorp and Dellaert 2015). In both arrangements, the financial institution benefits in terms of the interest of the loan as well as the service fee.

Some earlier studies have studied working capital management from the perspective of the forest industry. Pirttilä, Viskari and Kärri (2010) analyzed the cycle times of working capital in the value chain of 44 companies in the years 2004–2008. The results showed that the value chain ties up working capital: the cycle time of working capital (CCC) was positive in each stage of the value chain. In their study, the value chain was divided into three parts: the focal stage in the middle of the value chain was pulp and paper, while the upstream part of the chain was formed by three stages and the downstream by four stages. The results showed that the CCC was longest in the upstream, while it shortened on the way towards downstream. According to Pirttilä et al. (2014), the average CCC of the years 2006–2010 in the pulp and paper industry was roughly 60 days, which is longer than in the ICT industry (40 days) but shorter than in the automotive industry (70 days), and the differences are due to the cycle time

of inventories (DIO). In the value chain of the pulp and paper industry, the DIO was on average around 40 days. In the pulp and paper industry, the inventories and accounts receivable form approximately 20% of the total assets, which is equivalent to the share in the ICT industry (Pirttilä et al., 2014). The findings by Viskari, Pirttilä and Kärri (2011) indicate that companies in the value chain of the pulp and paper industry can improve their profitability by managing the components of working capital together.

As discussed above, working capital management has gained interest among academic researchers. The scholars have widely emphasized the collaborative perspective to working capital management in the supply chains and introduced innovative solutions to enhance the financial flows along the chain. However, working capital management is a complex issue and thus a challenging task even within a company, not to mention the even larger construct of a supply chain. Studies on the practical challenges of working capital management in companies and supply chains have been limited. In addition, previous studies on working capital management in the context of the pulp and paper industry concerned a time period when the industry was facing challenges for example due to the financial crisis. No studies have considered working capital management in the forest industry in recent years, when the impact of the structural change of the industry might have affected working capital management as well.

Research design

Research methods

This study contains aspects of both quantitative and qualitative research. First, financial value chain analysis (Lind et al., 2012) is conducted in one value chain stage with quantitative data collected from the financial statements of six paper and board producers for the period 2013–2016. The method is a seven-step process for analyzing the financial data in the value chain context, and it can be used to analyze financial phenomena in the value chain or in a certain value chain stage. In this study, we have applied the method in the paper and board stage of the value chain of the forest industry. The purpose of the analysis is to observe the competitive environment in terms of working capital by analyzing the current state of the working capital management of the companies. Also, the development of the cycle times of working capital during the observation period and in comparison to previous studies is analyzed. In addition to cycle times, we observe the working capital models of the companies and their working capital positions against each other in the WCM matrix (Lind, Monto and Kärri, 2017). In the second part of the study, a case study approach is applied. The case study is based on a semi-structured interview conducted in a case company, which was selected on the basis of the results of the financial analysis. The results of the financial value chain analysis indicated that the case company had managed it working capital most efficiently, and systematically shortened the cycle times during the observation period. The case study deepens the analysis of financial figures by complementing and providing information behind the quantitative data.

The sample of the study consists of six companies operating as paper and board producers in the forest industry. The companies were selected by following the approach presented in the paper by Pirttilä et al. (2014), where working capital management in the value chain of the pulp and paper industry was studied. In this study, we focus on the paper and board stage of the value chain. Six companies providing similar products were selected from the study of Pirttilä et al. (ibid.). The companies also operate mostly in the same geographic area (i.e. Northern Europe).

The operational working capital, consisting of inventories, accounts receivable, and accounts payable, is measured by cycle times in this study. The cycle time for working capital, i.e. cash conversion cycle (CCC), is calculated as follows:

$$CCC = DIO + DSO - DPO = \frac{Inventories}{Sales} \times 365 + \frac{Accounts\ receivable}{Sales} \times 365 - \frac{Accounts\ payable}{Sales} \times 365$$

In addition to CCC, DIO, DSO and DPO, we also considered the DSO-DPO relation, i.e. net trade credit (Nadiri, 1969), in the analysis of cycle times. This variable describes the difference between payment terms towards suppliers and customers.

Results

Cycle time analysis within paper and board companies

The cycle times of working capital and its components were calculated for each year of the 2013–2016 period. Figure 1 shows the cycle times, the average values and the change in each component from 2013 to 2016.

The results show that paper and board companies have different working capital levels. The CCC varies from the average of 44 days (Stora Enso and International Paper) to 77 days (Holmen). In other words, Holmen ties up working capital over one month longer than Stora Enso. The difference between these companies results mainly from inventories, but the DSO-DPO is also one week longer at Holmen than it is at Stora Enso. When looking at the development of the CCC during the observation period, the results show that despite the same average CCC, the cycle times of Stora Enso indicate a shortening trend, whereas the CCC of International Paper has lengthened. Altogether four companies have shortened their CCC mainly due to changes in the DSO-DPO relation. However, while Stora Enso has made the change by decreasing their DSO, the other three companies have increased their DPO. This indicates that the companies have used different working capital strategies. The results of Stora Enso is partially caused by the use of factoring services, which has been announced in their annual reports, in addition to tightening up their payment terms with the customers. The other three companies may not have been that keen on factoring, but they have been able to extend the cycle times of accounts payables for over 20 days at best (Metsä Group). Usually this kind of change is done by negotiating longer payment terms with the suppliers. It is also possible that reverse factoring has been used to stretch the DPO. When compared to a previous study in the forest industry (Pirttilä et al., 2010), the results show that four companies have a CCC shorter than the average CCC (62 days) of the pulp and paper stage. The DIOs are on a similar level in all companies except for Holmen, which has the longest DIO of the sample. The other companies have fairly similar levels of inventories to the findings by Pirttilä et al. (2010), where the average DIO of the pulp and paper stage was 45 days.

Stora Enso

	2013	2014	2015	2016	ave	Δ
DIO	44	46	46	46	46	2
DSO	45	45	38	34	41	-11
DPO	39	39	44	46	42	7
DSO-DPO	6	6	-6	-12	-1	-18
CCC	50	52	40	35	44	-15

International paper

	2013	2014	2015	2016	ave	Δ
DIO	35	37	36	42	38	7
DSO	44	44	40	48	44	4
DPO	36	41	34	40	38	4
DSO-DPO	7	3	7	8	6	0
CCC	43	40	43	50	44	7

Billerud Korsnäs

	2013	2014	2015	2016	ave	Δ
DIO	53	52	44	50	50	-3
DSO	44	45	41	44	43	0
DPO	32	44	44	51	42	19
DSO-DPO	12	2	-3	-7	1	-20
CCC	65	54	41	42	51	-23

Metsä Group

	2013	2014	2015	2016	ave	Δ
DIO	55	54	48	58	54	3
DSO	41	43	38	43	41	1
DPO	24	38	45	47	39	23
DSO-DPO	17	4	-7	-4	2	-21
CCC	72	58	41	54	56	-18

Holmen

	2013	2014	2015	2016	ave	Δ
DIO	71	73	70	70	71	0
DSO	47	53	45	51	49	4
DPO	45	43	44	42	43	-4
DSO-DPO	2	10	2	10	6	7
CCC	73	83	72	80	77	7

UPM

	2013	2014	2015	2016	ave	Δ
DIO	47	49	48	49	48	2
DSO	51	52	52	51	51	0
DPO	30	32	33	37	33	7
DSO-DPO	21	21	19	14	18	-7
CCC	67	69	67	63	67	-5

Figure 1. Cycle times of working capital in paper and board companies in 2013–2016.

Figure 2 shows the working capital models of the companies consisting of the material and financial flows of working capital, i.e. DIO and DSO-DPO. In this analysis, the average figures for the observation period were used. The figure shows that companies have applied different working capital models. Three of the companies, Stora Enso, Billerud Korsnäs and Metsä Group, are relatively close to each other with similar inventory levels. They also have a similar net trade credit. However, Stora Enso is the only company in this research sample having a longer DPO than DSO. Holmen stands out with larger inventories, whereas IP has managed its inventory in the most efficient way. The working capital model of UPM is relatively far from the other companies. Its DIO is not long, but the DSO-DPO is clearly longer than in the other companies. The analysis shows that even when operating within the same value chain stage, companies have applied different working capital models.

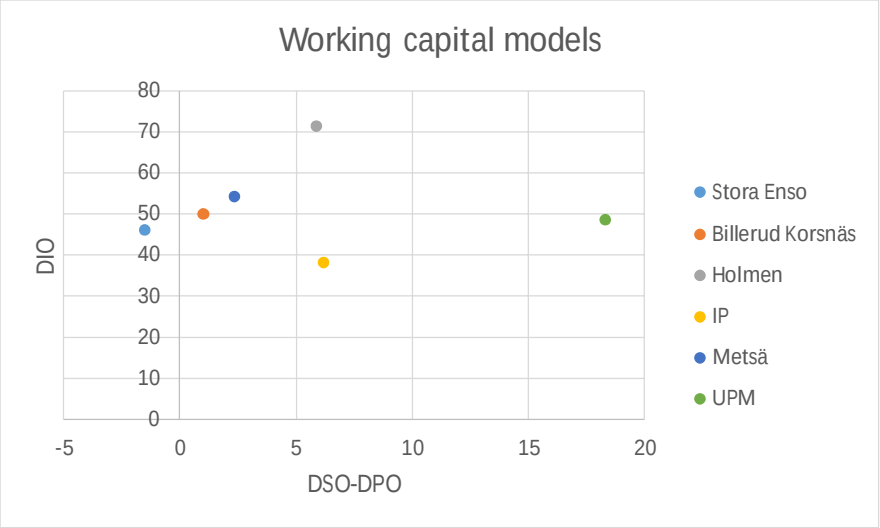


Figure 2. Working capital models of paper and board producers.

The results of the above analyses clearly showed that the importance of effective working capital management has been recognized in the companies. Most of the sample companies have

reduced their working capital remarkably during the four-year observation period. The results show that the DIO has remained on a fairly similar level. This may indicate that in the business of paper and board producers, certain inventories are required and they may have already reduced them to the optimal level. The reduction of working capital was done by adjusting the components of the financial flow, DSO and/or DPO.

Case Stora Enso

Working capital management in the company

The second part of the study is based on a semi-structural interview of the representative of the case company. The case company was selected on the basis of the results from the cycle time analysis. Stora Enso was an attractive target for a case study for two reasons. First, it had the shortest CCC of the sample companies, and second, the results indicated that the company has target-oriented and systematical working capital management. Thus, it was expected that an interview-based case study could deepen the results of this research and provide additional understanding of working capital management in the forest industry. In addition to the interview, the annual reports of the company have been reviewed and used to describe the working capital management of the company.

The interviewee had a leading position in one of the divisions of the case company, and has 15 years of experience from different functions within the company, including controlling, business development and supply chain. The interviewed person was selected through recommendations from other leaders in the company. The interview was conducted via Skype. Before the interview, the results of the numerical analysis of the cycle times studied in the first part as well as the cycle times of selected customers and suppliers were shared with the person. The results were also gone through at the beginning of the interview. The semi-structural interview focused on the present working capital management practices within the company as well as in the value chain.

The case company has performed systematic strategic work to decrease its working capital for over a decade now. This information is provided in the financial statements as well. The results of the analysis show that the company has succeeded in making its working capital management more effective: their working capital has been reduced remarkably during the last years. Within the company, this has required systematic leadership and management through target setting towards less tied-up working capital. The interviewee highlighted that these kinds of changes in the cycle times do not happen by accident. The reasons for aggressive working capital management and the reduction of working capital comes from the desired return of capital to the investors. Working capital can be affected faster than other items in the balance sheet in a capital intensive industry. There is constant pressure on both profit and the balance sheet. Operational working capital has been a key measure at different organizational levels. Managers responsible for the profit/loss have also targets related to working capital. It should also be acknowledged that the reduction of working capital is related to the structural change of the forest industry, including savings programs and decreasing the production of paper.

In the case company, working capital management is not separated from other financial results. The person responsible for the result is also responsible for the operational working capital. This way, sub-optimization is prevented. The responsibility and targets are implemented into all levels of the company from group to divisions and further to mill units. This way working capital is also taken into account in large investment decisions. The key question in business is: what is the optimal balance sheet that can be had without damaging the business and customer relations? In practice this is considered case by case. There is no other systematic

process to manage working capital in every decision, relation or unit. In the target setting, working capital is typically compared to sales. The key measure is relative, but cycle times (days) are not often used outside of inventory management, where the lead time is a common measure and followed already because of customer service.

Optimizing working capital is challenging, however. It simply cannot be minimized itself. The connection between the ability to make profit and working capital needs to be acknowledged. As the interviewed manager referred: "The best way to reduce working capital is to end the production and sales". By this, the interviewee highlighted the trade-offs in the management of working capital. The biggest challenge is to identify and consider the connection between the optimization of working capital and for example customer service, production efficiency, and production reliability (spare parts). Trade-offs between inventory levels and lead times, small receivables and cost of factoring, as well as long payment times and cash discounts are considered case by case on a daily basis. For example, when changing the service to a customer, it is considered what it requires from inventories and what is the effect of the change to the profits: are the consequences worth the increased working capital? There is still a long way for the holistic view and systematic process to do these kinds of assessments through all businesses and divisions.

Inter-organizational working capital management in the value chain
Even if largely emphasized in academic literature on working capital management and financial supply chains, inter-organizational working capital management is still quite new an approach. The case company faces a lot of challenges related to working capital collaboration. Working capital components, inventories and trade credit, are open in negotiations and can be settled case by case, but it is still far from actual collaboration. Still, the cycle times of trade credit and their development in the case company was seen as information that should not be shared with the suppliers and customers, even though the data is publicly available to anyone.

Some supply chain finance tools have been used in the case company. The clear major action that Stora Enso has taken in order to reduce working capital is factoring, selling their receivables to a third party that releases working capital and shortens the cycle time of accounts receivable. VMI inventory settlements are one example of collaborative working capital management actions that have been done with the customers. It has increased the working capital of the case company but, at the same time, the material circulates faster and the working capital of the customer is reduced, and thus working capital is released from the value chain.

Collaboration in working capital management through the value chain is challenging. It is a question of transparency and trust. The value chain structure prevents total transparency towards the end customers. Converters and merchants between Stora Enso and the final customers try to hold their positions in the value chain and prevent transparency. It is also a question of power in the value chain. The fight for the power in the value chain is strong and it makes the collaboration harder. This may also slow down new innovations and services regarding the optimization of working capital in the value chain.

Discussion and conclusions
A single company has limited options to reduce its working capital. The cycle times of trade credit are affected by the credit terms provided by the suppliers as well as the payment practices by the customers. The fact stands up for the value chain perspective of working capital. Factoring, i.e. selling accounts receivables to a third party in order to meet the immediate needs of cash, is an option that enables a company to affect its cycle time of accounts receivable, but

the service has its costs as well. Could it be a more sustainable option for an industry to collectively shorten their payment terms? One company cannot dramatically change the established payment practices within the value chain, and individually made actions regarding working capital management are slow. Which actors in the value chain are the most powerful ones that could lead the credit terms and working capital management to a new, more efficient era? An interesting issue arising from the interview was the sensitivity regarding the cycle times of trade credit components, DSO and DPO. The cycle times are linked with payment terms, and even though the balance sheets are publicly available to anyone, it was considered as information that should not be shared with the value chain partners. Do the companies not use this kind of data in their negotiations with suppliers and customers? Would this kind of data have an impact on the negotiations of payment terms?

Managing working capital is about seeking the correct balance between the optimization of cycle times and costs. In addition, there is a trade-off concerning sufficient material availability to fulfill the customer needs as well as sales increase via more generous payment terms. Working capital management is a complex issue even within one company, and responsibility for different working capital components is divided between different functions within the firm. Is value chain wide collaboration, suggested by several researchers, still a distant objective which works in theory, but, in practice, is too modern and complicated an idea to take into account? It seems to be a question of trust and power.

This paper concerned working capital management in paper and board companies and sought for an understanding on the practical challenges regarding intra- and inter-organizational working capital management. The results of the analysis of cycle times of working capital were complemented by conducting an interview in a case company. The findings showed that working capital has been reduced in the case company as well as in few other paper and board producers. This has been done by adjusting payment terms. In the case company, the reduction of working capital has been a strategic action, and factoring has been used to shorten the cycle time of accounts receivable. Moreover, the reduction of working capital is linked with the structural change of the forest industry. This working paper serves as a starting point for new studies regarding working capital management and financial supply chains, and provides several directions for further research. First, more interviews could be conducted in order to form a comprehensive picture of working capital management and its role in the case company. Second, the analysis of the cycle times of working capital in the stage of paper and board producers showed that there have been remarkable changes in working capital during the last years. It would be interesting to replicate the analysis in the total value chain of the forest industry to analyze current working capital management in comparison to studies by Pirttilä et al. (2010, 2014). Third, combining the numerical financial value chain analysis with interviews in the value chain could provide interesting information about how inter-organizational working capital management is seen at different parts of the value chain, and how the challenges regarding intra-organizational working capital differ from stage to stage.

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Leveraging inter-organizational working capital management by digitalizing the financial flows in the supply chain

Lotta Lind[1], Florian Schupp[2], Timo Kärri[1]
[1]LUT School of Business and Management, Skinnarilankatu 34, 53850 Lappeenranta, Finland
[2]Schaeffler Technologies, Industriestrasse 1–3, 91074 Herzogenaurach, Germany
e-mail: lotta.m.lind@gmail.com; schupp-florian@t-online.de; timo.karri@lut.fi
Tel.: +358503098181; +491728415370; +358408677280

Summary
This study aims at improving inter-organizational working capital (WC) management by developing a solution for managing the financial flows in supply chains. The paper presents the current state of the cycle times of financial flows and proposes a model for WC optimization in the supply chain via payment term adjustments. The model is tested with seven scenarios, which show that remarkable amounts of WC could be released by adjusting and harmonizing the payment terms in the supply chain. The introduced model provides a novel perspective on collaborative WC management in the supply chain by enabling win-win situations with a unique incentive system. The paper provides practical support for the optimization of WC at the supply chain level.
Keywords: Digitalization in purchasing, Working capital management, Financial supply chain management
Submission category: Working paper

Introduction and background

Financial issues and the management of working capital (WC) in the supply chain context have gained increasing attention in recent years, and the concept of financial supply chain management has brought the financial flow into the definition of supply chain (e.g. Wuttke, Blome and Henke, 2013). Companies experience pressure to extend their payment terms towards suppliers in order to release cash to be used for strategic investments and growth. At the most, payment terms tie up WC for 90 or even 120 days. For this period, many suppliers are forced to turn towards external funding sources in order to cover the expenses of their operations, which increases their financing costs. However, according to previous research (e.g. Kroes and Manikas, 2014), the increase of accounts payable at the expense of suppliers benefits the buying company only in the short term. In this study, our aim is to provide an alternative for the payment term extensions of individual companies by introducing a model for collaborative payment term adjustment in the supply chain in order to achieve a win-win situation and release WC from the supply chain for more productive use.

Supply chain finance solutions (e.g. reverse factoring) aim at win-win situations for buyers, suppliers and financial institutions (Liebl, Hartmann and Feisel, 2016). In reverse factoring, a buyer provides the supplier an access to cash on the buyer's credit rating, while the buyer benefits from the reduced WC by extending the cycle time of accounts payable without affecting the cycle time of the accounts receivable of the supplier (Grüter and Wuttke, 2017). The financial institutions benefit in terms of interest rate and service fee. But what if the companies collaborated to release WC from the supply chain without financial institutions? Would it be possible to find a win-win solution that benefits all supply chain partners? In this paper, we study collaborative WC management, consisting of the management of inventories and trade credit, i.e. accounts receivable and accounts payable. Our hypothesis is that by

adjusting and harmonizing payment terms, WC can be released from the supply chain in a way that all its members benefit. The objective of the paper is to develop and test the model for releasing WC through payment term adjustments. The two research questions of the study are as follows: 1) How could the optimization and standardization of payment terms be accomplished in the supply chain? 2) How do the adjustment and standardization of payment terms affect the WC in the supply chain?

The model is tested with scenarios in the context of an automotive supply chain. Previous research on WC management in the automotive industry has shown that the automotive companies have potential to release WC (Lind et al., 2012; Brandenburg, 2016). The results have shown that tightened payment terms required by the suppliers affected the ones provided for customers (Lind et al., 2012). The effect was visible throughout the value chain, as the changes in the cycle times of accounts receivable and accounts payable offset each other. Viskari et al. (2012) observed the connection between WC management and profitability in the automotive industry. Their results showed that a radical reduction in payment terms would improve the profitability of the whole value chain the most. This would require collaborative actions with the value chain partners, which has been emphasized by several studies (e.g. Randall and Farris, 2009; Viskari and Kärri, 2012), but the results of Vázquez, Sartal and Lozano-Lozano (2016) showed that WC in the automotive sector is not managed in a collaborative way. Even if the academic studies have reported benefits of inter-organizational WC management, the realization of such collaboration in practice is not a simple task. One major barrier in this is trust between the supply chain partners. Payment terms are negotiation issues between the companies, and they are not visible nor controlled at the supply chain level.

Digitalization provides opportunities for more efficient processes and cost savings in the supply chains. In FSCM, significant potential lies in the possibility of transparent and real-time information. Sharing accurate information in the supply chain, setting targets for WC management at the supply chain level, and monitoring the realized cycle times in real-time, are ways by which trust between the supply chain partners could be enhanced and tied-up WC in the supply chain released (see Figure 1). This would improve the overall efficiency of the financial supply chain.

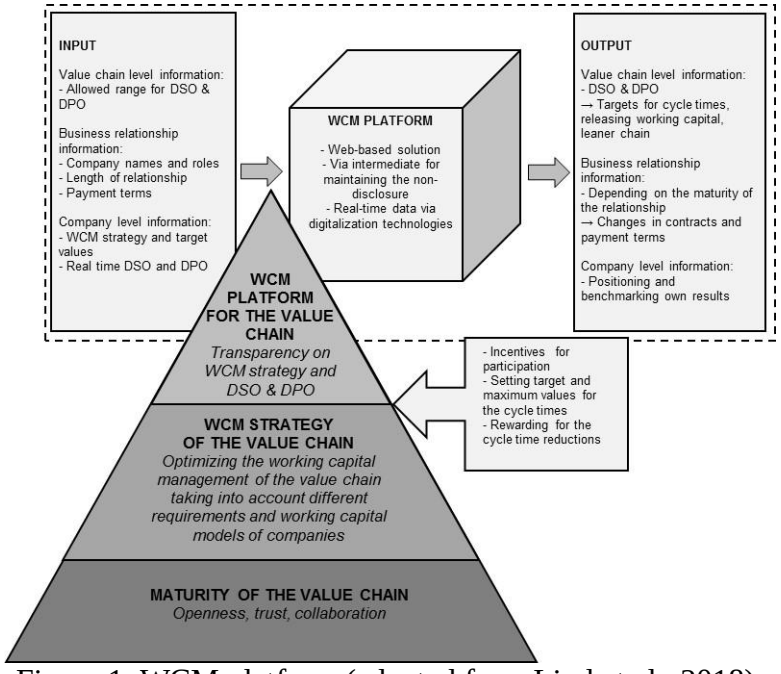

Figure 1. WCM platform (adapted from Lind et al., 2018).

Figure 1 describes the framework of this study. The figure is adapted from the study of Lind et al. (2018) according to the scope of this study and only considers the trade credit components of WC. The purpose of the WCM platform is to combine the WC data from the supply chain actors, and provide information for monitoring and managing inter-organizational WC. In this study, we study the potential benefits gained by applying the WCM platform in the supply chain.

The paper is structured as follows. The first section provided an introduction and background for the topic of the study, including a review of previous research and the objectives and research questions of the paper. The next section represents the data, measures and methods of the study. It is followed by a section introducing the model for payment term adjustment in the supply chain context. In the results section, the current state of the cycle times of WC in the sample companies is presented, and then this information is used as a basis for seven scenarios, which are used to test the model and to find the most optimal payment term configuration for the automotive supply chain. The final section provides the discussion, conclusions and objectives for further research.

Data, measures and methods

The effects of the optimization and standardization of payment terms is analyzed in the context of an automotive supply chain. The sample of the study contains 35 companies, and it describes the supply chain of the automotive industry consisting of four consecutive stages from refined raw material suppliers via component and system suppliers to car manufacturers. Each stage is represented by 4–16 companies. The sample companies were selected by following the approach by the study of Lind et al. (2012). The structure and the companies of the sample supply chain are provided in the results section.

The data for the analysis was collected from the official consolidated financial statements of the years 2011–2015. The values for inventories, accounts receivable, and accounts payable, i.e. the components of operational WC, were gathered and used to calculate the cycle times. Additionally, information on the actual shares of companies' sales concerning the automotive industry was gathered by reviewing annual reports and company websites. For most companies, exact or estimated shares were found from the official sources. For the remaining companies, the typical share of the stage was used in the analysis. Only car manufacturers were considered operating 100% in the automotive industry.

In this study, WC is measured by cycle times. We used the following formulas for the cycle times of WC (CCC) and its components:

$$CCC = DIO + DSO - DPO \quad (1)$$
$$DIO = Inventories/sales*365 \quad (2)$$
$$DSO = Accounts\ receivable / Sales * 365 \quad (3)$$
$$DPO = Accounts\ payable / Sales * 365 \quad (4)$$

In the analysis of the cycle times, average values of the observation period were used. This approach provides a more realistic view of the WC level of the companies by balancing the effects of possible exceptional years.

The analysis part of the study is twofold. First, the current state of the cycle times of WC in the supply chain is analyzed using the financial value chain analysis (Lind et al., 2012). This

analysis is used as a basis for the second part of the analysis, where scenarios are used to construct different possibilities for optimizing the WC of the supply chain with payment terms. This has been done by testing different values for the DSO and DPO in our model, and by analyzing their effects on the total WC of companies in regard to cycle times as well as monetary values. We present seven scenarios for the optimization of WC by modifying the trade credit components, i.e. DSO and DPO. The scenarios are introduced in the results section. The target of the payment term optimization in this paper is to find win-win solutions for all supply chain members. Therefore, sharing the benefits of the released WC is considered in the model.

Model for optimizing the financial flows of working capital in the supply chain

On the basis of the WCM platform (Lind et al., 2018), we developed a model which can be used to optimize the financial flows of WC in the supply chains by adjusting the cycle times of accounts receivable and accounts payable. The model is illustrated in Figure 2, and it describes the context in which the WCM platform can be used. The supply chain of the study has four stages that consist of companies operating in the same part of the chain. Except for car manufacturers, it is assumed that companies do not operate in the automotive industry only. Thus, the model considers the shares each company has with the supply chain partners. As described in Figure 2, the DPO of refined raw material suppliers as well as the DSO of car manufacturers are out of the scope of the model. This means that in this model, these components remain unchanged. The supply chain of this study cannot affect the cycle times of these WC components, as the suppliers of refined raw material suppliers as well as the customers of car manufacturers are not included in the study.

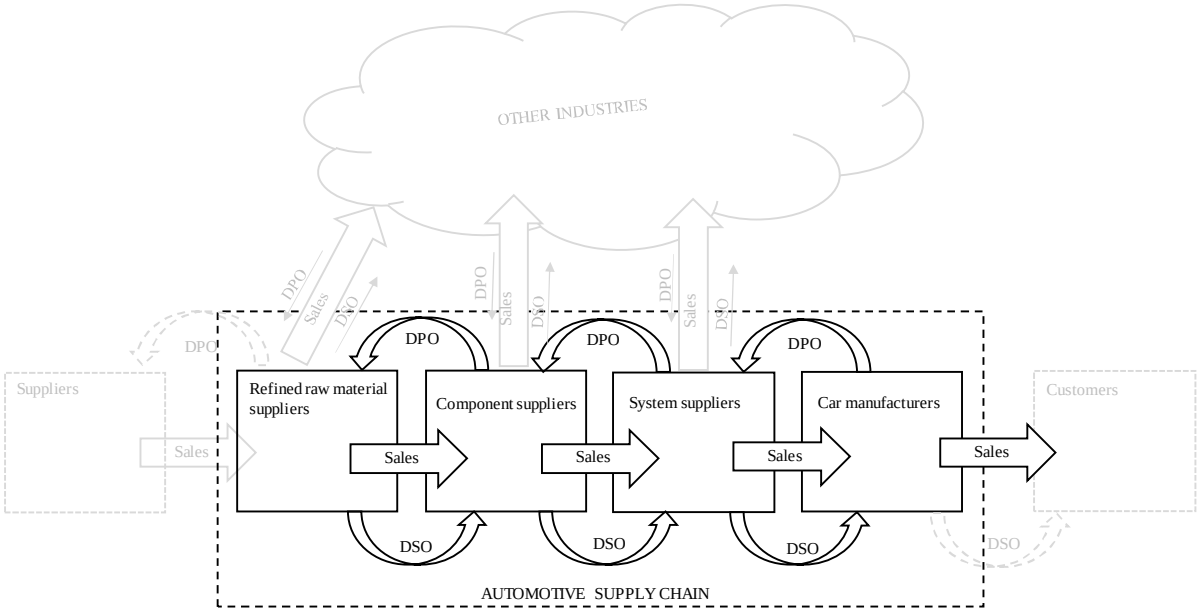

Figure 2. Model for optimizing the financial flows of WC.

When adjusting the DSO and DPO in this study, all companies within the stage will have the same DSO and DPO concerning the sales and purchases with other participants. In other words, the payment terms are harmonized in a way that all companies of the stage have the same payment terms in their business relationships with the companies of the previous stage, as well as with the companies of the following one. However, the payment terms may not be the same towards upstream and downstream. As the model represents the supply chain, the new DSO of

the suppliers defines and is equal to the new DPO of the customers, and vice versa. It is assumed that all supply chain partners participate in the optimization of the financial flows, and thus, new DSOs and DPOs can be set by the supply chain. The core idea of the model is to find a win-win situation by adjusting the DSOs and DPOs, ceteris paribus. However, with the restrictions concerning the harmonization of the cycle times within the stages, it is assumed that a solution in which every company would be able to "win", i.e. release WC, is not possible. Therefore, it was necessary to develop a settlement that also motivates these companies to participate in this supply chain wide payment term harmonization. In this study, we calculated a compensation for the companies whose WC increased. The compensation includes the amount of additional tied-up WC with a 15% interest. This is paid by the winning supply chain companies, who pay this in equal share (%) from their released WC.

Results

Current cycle times

Figure 3 shows the average figures for the observation period, and describes the current state of WC management in the sample companies. In addition to the cycle times, the table shows the average sales and WC of companies, as well as the exact or estimated share of the sales each company has in the automotive industry.

Stage 1: Refined raw material suppliers

	DIO	DSO	DPO	DSO-DPO	CCC	Sales (M€)	WC (M€)	Automotive share (%)
ArcelorMittal	81	20	53	-33	48	61 970	8 137	20 %
Dupont	80	61	50	11	92	26 012	6 528	20 %*
EMS	61	50	22	28	89	1 548	376	20 %*
Evonik	46	46	30	17	63	13 493	2 314	20 %
Lanxess	60	46	33	13	73	8 415	1 683	20 %
Salzgitter	77	59	37	22	99	9 405	2 560	20 %*
ThyssenKrupp	62	46	39	7	70	41 224	7 869	23 %
AVERAGE	67	47	38	9	76	23 153	4 210	

Stage 2: Component suppliers

	DIO	DSO	DPO	DSO-DPO	CCC	Sales (M€)	WC (M€)	Automotive share (%)
Alps	44	64	35	28	72	5 291	1 045	67 %
Austria Microsystems	53	54	30	24	76	426	89	35 %
Bekaert	64	74	39	35	99	3 375	913	45 %
Daetwyler	50	48	20	28	78	1 093	233	60 %*
ElringKlinger	78	66	21	45	123	1 234	415	90 %
Federal Mogul	59	70	43	27	85	5 491	1 285	60 %*
Georg Fischer	63	57	39	18	81	3 117	694	36 %
GKN	51	62	82	-20	31	8 335	713	60 %
Hella	39	50	38	12	51	5 468	770	76 %
Leoni	47	48	63	-16	31	4 007	341	60 %*
Miba	50	55	35	20	70	640	123	60 %*
Nidec	53	84	65	19	72	7 184	1 422	60 %*
Polytec	33	39	28	10	43	547	65	90 %
Rheinmetall	69	82	54	28	97	4 728	1 261	50 %
Saint-Gobain	54	44	52	-9	45	41 603	5 132	20 %
Tyco	24	59	30	30	53	9 058	1 324	60 %*
AVERAGE	52	60	42	18	69	6 350	989	

Stage 3: System suppliers

	DIO	DSO	DPO	DSO-DPO	CCC	Sales (M€)	WC (M€)	Automotive share (%)
Schaeffler Group	51	55	33	22	73	11 675	2 330	76 %
Continental	33	60	50	10	43	34 062	4 008	60 %
Bosch	52	65	29	36	88	53 917	13 053	60 %
Mahle	44	60	34	26	70	8 106	1 556	75 %
ZF Sachs	38	51	46	5	43	19 456	2 300	93 %
Valeo	26	50	76	-26	0	12 401	3	87 %
BorgWarner	25	64	70	-7	18	5 957	297	75 %*
Magna	28	57	52	5	33	25 485	2 337	75 %*
AVERAGE	37	58	49	9	46	21 382	3 235	

Stage 4: Car manufacturers

	DIO	DSO	DPO	DSO-DPO	CCC	Sales (M€)	WC (M€)	Automotive share (%)
BMW	47	12	32	-20	28	78 861	5 918	100 %
Daimler	57	24	29	-5	53	123 632	17 760	100 %
VW	57	21	35	-14	43	192 954	23 101	100 %
Renault	33	10	59	-49	-16	42 242	-1 905	100 %
AVERAGE	49	17	39	-22	27	109 422	11 219	

Note: Automotive shares are exact or estimated figures from the annual reports or company websites.
Shares marked with * are set as typical shares in the stage as no other information was available.

Figure 3. Current cycle times in the sample according to average figures from 2011–2015.

The results show that the beginning of the chain ties up relatively more WC, and the CCC gets shorter stage by stage towards downstream. However, when looking at the amount of WC in euros, the tied up WC of car manufacturers is remarkably higher due to the largest sales volumes. This means that when measured in euros, shortening the CCC by one day releases much more WC in the stage of car manufacturers than in the stage of component suppliers, for

example. A closer look at the trade credit components, DSO and DPO, reveals that the differences between the companies and within the stages are remarkable, varying from 12–84 days in the DSO and 20–76 days in the DPO. In most companies, the DSO is longer than the DPO, which indicates that the payment terms towards customers are usually longer than the ones towards suppliers. However, there are also 10 companies that have a negative DSO-DPO. The CCCs of these companies were also among the shortest in their stages, which indicates that they have been successful in their WC management. This kind of WC model is beneficial for the company itself, but not from the perspective of the supply chain as a long DPO is gained by stretching the DSO of the suppliers, and a short DSO requires fast payments from the customer. Thus, this WC model cannot be applied by every company in the supply chain.

Scenarios

Next, all scenarios and their results are introduced. All scenarios with adjusted DSO and DPO, their effect on the CCCs of companies, the amount of released WC, the amount of compensation paid or received by the company, as well as the eventual benefits of the payment term adjustment in euros, are shown in Appendix. Table 2 concludes the findings of the scenarios.

Table 2. Summary of the scenarios and findings.

	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
Name of the scenario	*Least losers*	*Same payment term throughout the chain*	*Happy upstream*	*Happy downstream*	*Long payment terms*	*Short payment terms*	*Bringing DSO and DPO closer together*
New DSO starting from upstream	30-40-40-(old)	38-38-38-(old)	35-30-30-30-(old)	45-45-35-(old)	50-52-45-(old)	25-30-35-(old)	45-55-60-(old)
New DPO starting from upstream	(old)-30-40-40	(old)-38-38-38	(old)-35-30-30	(old)-45-45-35	(old)-50-52-45	(old)-25-30-35	(old)-45-55-60
Average CCC of the sample (current)	61	61	61	61	61	61	61
Average CCC of the stages (current)	55	55	55	55	55	55	55
Average CCC of the sample (new)	56	54	53	53	53	56	55
Average CCC of the stages (new)	51	50	51	49	48	52	47
CCC Δ (average of the sample)	-4	-7	-7	-8	-8	-5	-5
CCC Δ (average of the stages)	-4	-4	-3	-5	-7	-3	-7
Number of losers	7	7	9	6	10	7	6
Number of winners	28	28	26	29	25	28	29
Released WC in total (M€)	11616,6	9693,4	983,1	8742,5	19042,9	5042,2	32570,7
Released WC of winners (M€)	16043,3	14192,3	9053,7	13450,9	23083,5	9871,3	35493,7
Total loss of losers (M€)	-4426,7	-4498,9	-8070,6	-4708,4	-4040,6	-4829,1	-2923,0
Paid to losers (M€)	5090,7	5173,8	9281,2	5414,6	4646,7	5553,5	3361,4
% winners pay from their released WC to losers	31,73 %	36,45 %	102,51 %	40,25 %	20,13 %	56,26 %	9,47 %

Scenario 1: The least losers

The target of the scenario was to adjust the DSOs and DPOs by having as little companies increasing their WC as possible. The adjustment started from the upstream, where we selected 30 days as the new DSO for the automotive industry. This was seen as the best possible reasonable DSO value for the stage, as with this cycle time most companies release WC. The same logic was applied throughout the chain. The results show that Scenario 1 would release WC from the supply chain. Seven companies, all of them originally having a longer DPO than DSO, had to increase their WC.

Scenario 2: Same payment term through the chain

Scenario 2 also started from the upstream. The new DSO for refined raw material suppliers, 38 days, was based on the average DPO of these companies. The idea of the scenario was to test the consequences of the whole supply chain applying the same payment term. This scenario released less WC than the first one even if the number of losers was the same. The main reason for this was that the car manufacturers released less WC. From the perspective of the supply chain, it would be beneficial that the car manufacturers, who have the biggest sales volume, would be able to shorten their CCC.

Scenario 3: Happy upstream

Scenario 3 also started from the upstream. The aim of this scenario was to set new cycle times so that it would benefit companies in the upstream, but still keep realistic DSO and DPO values. Optimization was started by setting 35 days as the new DSO for the refined raw material suppliers. The results of the scenario showed that this option is not reasonable. The scenario released the least WC, and is not applicable, as the compensation to the losers was higher than the WC released by the winners.

Scenario 4: Happy downstream

Scenario 4 is the opposite of Scenario 3. As shown by the results of Scenarios 1–3, the supply chain benefits in total if the car manufacturers are able to release WC. Therefore, the adjustment was started from the downstream. The new DPO of the car manufacturers was set to 35 days, which was seen as a realistic option. In this scenario, only six companies had to increase their WC, which was the lowest number so far. However, the amount of released WC was lower than in Scenarios 1 and 2. Even if the payment term adjustments were started from the car manufacturers, they were moderate, and thus did not lead to a remarkable release of WC within the stage. In addition, the compensation required by company Renault was remarkably higher than in Scenarios 1 and 2.

Scenario 5: Long payment terms

In Scenario 5, long payment terms starting from the downstream were tested. The new DPO of the car manufacturers was 45 days, which led to remarkable reductions in the CCC for all companies in the stage except for Renault. This scenario released explicitly more WC than the previous ones. However, the number of losers was 10, which is the highest of all scenarios. This scenario causes increases in WC especially for the companies in the upstream.

Scenario 6: Short payment terms

Scenario 6 also started from the downstream. In this scenario, shorter DSOs and DPOs were tested. The DPO of car manufacturers was set to 35 days according to the second highest DPO of the stage. This scenario led to the second lowest WC release of the study. This resulted from the remarkable compensations required by the companies in the downstream. However, unlike Scenario 3, all companies gained benefits with this scenario, but the winners had to pay over 56% of their released WC to the losers.

Scenario 7: Bringing DSO and DPO closer together

The target of Scenario 7 was to make the difference between the DSO and the DPO shorter in each stage. The adjustment of the cycle times was started from the upstream by setting the new DSO to 45 days. With this value, the CCCs of most companies in the stage remain on the same level or reduce slightly. This scenario differs from the others by focusing on the relation between the DSO and DPO instead of concentrating on the components individually. The results show that this scenario was the most beneficial for the supply chain. It released over 32 billion euro of WC in total, and only six companies increased their WC. Also, the percentage of the released WC paid by the winners was the lowest.

Discussion and conclusions

In this paper, we presented a model for WC optimization through payment term adjustments. This model provides a solution for accomplishing the optimization and standardization of payment terms in the supply chain. The analysis of the current cycle times of WC showed that the cycle times of WC were longer in the upstream. However, shortening the cycle time of WC by one day releases more WC in the downstream due to a higher sales volume. The results of the scenario analysis showed that win-win situations (i.e. companies gaining financial benefits from the released WC of the supply chain) can be achieved by collaborating in terms of payment term adjustment and standardization within the supply chain. However, this was not possible without a compensation system that was included in our model. The most beneficial option was to bring the DSO and DPO closer together in all stages of the supply chain. This would release a remarkable amount of WC.

This study takes an initial step towards a practical solution for monitoring the financial flows in supply chains. By using the new technologies enabled by digitalization, a tool for managing WC in the supply chains could be developed. However, it should be carefully designed to ensure a certain anonymity and security within the system. Even if the system could provide visibility and transparency to the financial flows in the supply chain, it should be planned in a way that participants can trust the system as well as each other. Also, the legal aspects need to be considered when making a more detailed requirement specification for the system. Participants are required to enter fairly sensitive data into the system, such as payment terms and sales and purchase volumes with other participants, which may be a legal issue as well.

How should the implementation of such a system, as described in this paper, be accomplished? What would be the best way to have as many participants from the supply chain as possible? Of course, it depends on the position of the initiator. In the first tier (i.e. system suppliers), one possibility is to start the negotiations with one's own suppliers and their suppliers. Once they agree to participate, negotiations with one car manufacturer could be started, and the car manufacturer, in turn, would use its negotiation power to involve other system suppliers. The system could also be tested with a completely new business and new supply chain. As they would not have established practices that require changes, they could directly adapt to the collaborative WC management practices, and serve as a demonstration of the benefits of the system to others.

Future research

As a working paper, the paper still has several limitations which offer avenues for future research. The authors suggest future research regarding the development of the solution to be conducted in the following areas: 1) Supply chain visibility as a prerequisite for the tool implementation, 2) The limiting factors of such a WC management platform, e.g. legal restrictions or frame conditions, 3) Testing and further development of the application with pilot companies, and 4) A common WC management strategy for the supply chains the pilot companies are elements of, including motivation for participation. Additionally, it should be noted that WC management is not only about the management of trade credit, but inventory management is also an essential element in it. The following phase in the planning of such a system is to ensure that the corresponding material flow keeps up with the new, more efficient financial flow.

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APPENDIX. Results of different scenarios.

		Current		Scenario 1: "Least losers"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	30	22	53	53	2	-345,5		397,4	51,8
	Dupont	61	50	30	55	50	50	-6	448,7	142,4		306,3
	EMS	50	22	30	46	22	22	-4	16,9	5,4		11,5
	Evonik	46	30	30	43	30	30	-3	120,7	38,3		82,4
	Lanxess	46	33	30	43	33	33	-3	73,8	23,4		50,4
	Salzgitter	59	37	30	53	37	37	-6	149,3	47,4		101,9
	ThyssenKrupp	46	39	30	42	39	39	-4	420,3	133,4		286,9
Component suppliers	Alps	64	35	40	48	30	32	-12	176,9	56,1		120,8
	Austria Microsystems	54	30	40	49	30	30	-5	5,6	1,8		3,8
	Bekaert	74	39	40	58	30	35	-11	102,9	32,7		70,3
	Daetwyler	48	20	40	43	30	26	-11	32,3	10,2		22,0
	ElringKlinger AG	66	21	40	43	30	29	-32	106,5	33,8		72,7
	Federal Mogul	70	43	40	52	30	35	-10	150,9	47,9		103,0
	Georg Fischer	57	39	40	51	30	36	-3	24,6	7,8		16,8
	GKN	62	82	40	49	30	51	18	-406,7		467,7	61,0
	Hella	50	38	40	43	30	32	-2	24,6	7,8		16,8
	Leoni	48	63	40	43	30	43	15	-169,6		195,0	25,4
	Miba	55	35	40	46	30	32	-6	10,5	3,3		7,2
	Nidec	84	65	40	57	30	44	-5	107,9	34,2		73,7
	Polytec	39	28	40	40	30	30	0	0,7	0,2		0,4
	Rheinmetall	82	54	40	61	30	42	-9	119,5	37,9		81,6
	Saint-Gobain	44	52	40	43	30	48	4	-426,2		490,1	63,9
	Tyco	59	30	40	48	30	30	-12	293,2	93,0		200,2
System suppliers	Schaeffler Group	55	33	40	44	40	38	-17	532,7	169,0		363,7
	Continental	60	50	40	48	40	44	-6	578,7	183,6		395,1
	Bosch	65	29	40	50	40	35	-22	3234,9	1026,5		2208,5
	Mahle	60	34	40	45	40	39	-19	427,2	135,5		291,6
	ZF Sachs	51	46	40	41	40	40	-5	270,3	85,8		184,5
	Valeo	50	76	40	41	40	45	23	-776,7		893,2	116,5
	BorgWarner	64	70	40	46	40	48	5	-79,8		91,8	12,0
	Magna	57	52	40	44	40	43	-4	287,0	91,1		196,0
Car manufacturers	BMW	12	32	12	12	40	40	-8	1705,8	541,3		1164,5
	Daimler	24	29	24	24	40	40	-11	3842,8	1219,3		2623,4
	VW	21	35	21	21	40	40	-5	2778,1	881,5		1896,6
	Renault	10	59	10	10	40	40	19	-2222,0		2555,3	333,3
								TOTAL	**11616,6**	**5090,7**	**5090,7**	**11616,6**

	Scenario 2: "Same payment term through the chain"								
	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
ArcelorMittal	38	23	53	53	4	-617,2		709,8	92,6
Dupont	38	57	50	50	-5	334,6	122,0		212,6
EMS	38	48	22	22	-2	10,1	3,7		6,4
Evonik	38	45	30	30	-2	61,6	22,5		39,1
Lanxess	38	44	33	33	-2	36,9	13,4		23,4
Salzgitter	38	55	37	37	-4	108,1	39,4		68,7
ThyssenKrupp	38	44	39	39	-2	212,5	77,5		135,0
Alps	38	46	38	37	-19	274,0	99,9		174,1
Austria Microsystems	38	48	38	33	-8	9,7	3,5		6,2
Bekaert	38	58	38	38	-16	144,6	52,7		91,9
Daetwyler	38	42	38	31	-17	50,3	18,3		31,9
ElringKlinger AG	38	41	38	36	-41	136,9	49,9		87,0
Federal Mogul	38	51	38	40	-16	241,1	87,9		153,2
Georg Fischer	38	50	38	39	-6	55,4	20,2		35,2
GKN	38	48	38	56	12	-269,7		310,2	40,5
Hella	38	41	38	38	-9	138,4	50,5		88,0
Leoni	38	42	38	48	9	-103,7		119,3	15,6
Miba	38	45	38	37	-12	21,1	7,7		13,4
Nidec	38	56	38	49	-11	226,0	82,4		143,6
Polytec	38	38	38	37	-9	14,1	5,2		9,0
Rheinmetall	38	60	38	46	-14	184,3	67,2		117,1
Saint-Gobain	38	43	38	50	2	-198,2		228,0	29,7
Tyco	38	47	38	35	-18	442,1	161,2		280,9
Schaeffler Group	38	42	38	37	-17	532,7	194,2		338,5
Continental	38	47	38	43	-6	578,7	211,0		367,8
Bosch	38	49	38	34	-22	3234,9	1179,3		2055,6
Mahle	38	43	38	37	-19	427,2	155,7		271,4
ZF Sachs	38	39	38	39	-5	270,3	98,5		171,8
Valeo	38	40	38	43	23	-776,7		893,2	116,5
BorgWarner	38	44	38	46	5	-79,8		91,8	12,0
Magna	38	43	38	41	-4	287,0	104,6		182,4
BMW	12	12	32	38	-6	1273,7	464,3		809,4
Daimler	24	24	29	38	-9	3165,3	1153,9		2011,4
VW	21	21	35	38	-3	1720,8	627,3		1093,5
Renault	10	10	59	38	21	-2453,5		2821,5	368,0
					TOTAL	**9693,4**	**5173,8**	**5173,8**	**9693,4**

	Scenario 3: "Happy upstream"								
	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
ArcelorMittal	35	23	53	53	3	-515,3		592,6	77,3
Dupont	35	56	50	50	-5	377,4	386,9		-9,5
EMS	35	47	22	22	-3	12,6	12,9		-0,3
Evonik	35	44	30	30	-2	83,8	85,9		-2,1
Lanxess	35	44	33	33	-2	50,7	52,0		-1,3
Salzgitter	35	54	37	37	-5	123,6	126,7		-3,1
ThyssenKrupp	35	44	39	39	-3	290,4	297,7		-7,3
Alps	30	41	35	35	-22	322,6	330,7		-8,1
Austria Microsystems	30	45	35	32	-10	11,7	12,0		-0,3
Bekaert	30	54	35	37	-18	165,4	169,5		-4,2
Daetwyler	30	37	35	29	-20	59,2	60,7		-1,5
ElringKlinger AG	30	34	35	34	-45	152,1	155,9		-3,8
Federal Mogul	30	46	35	38	-19	286,2	293,4		-7,2
Georg Fischer	30	47	35	38	-8	70,8	72,5		-1,8
GKN	30	43	35	54	9	-201,2		231,4	30,2
Hella	30	35	35	36	-13	195,4	200,3		-4,9
Leoni	30	37	35	46	6	-70,8		81,4	10,6
Miba	30	40	35	35	-15	26,3	27,0		-0,7
Nidec	30	51	35	47	-14	285,0	292,2		-7,2
Polytec	30	31	35	34	-14	20,9	21,4		-0,5
Rheinmetall	30	56	35	44	-17	216,6	222,1		-5,4
Saint-Gobain	30	41	35	49	1	-84,3		96,9	12,6
Tyco	30	42	35	33	-21	516,6	529,5		-13,0
Schaeffler Group	30	36	30	31	-17	532,7	546,1		-13,4
Continental	30	42	30	38	-6	578,7	593,3		-14,5
Bosch	30	44	30	29	-22	3234,9	3316,2		-81,3
Mahle	30	37	30	31	-19	427,2	437,9		-10,7
ZF Sachs	30	31	30	31	-5	270,3	277,1		-6,8
Valeo	30	33	30	36	23	-776,7		893,2	116,5
BorgWarner	30	38	30	40	5	-79,8		91,8	12,0
Magna	30	37	30	35	-4	287,0	294,3		-7,2
BMW	12	12	30	30	2	-454,8		523,0	68,2
Daimler	24	24	30	30	-1	455,6	467,0		-11,4
VW	21	21	30	30	5	-2508,3		2884,5	376,2
Renault	10	10	30	30	29	-3379,4		3886,3	506,9
					TOTAL	**983,1**	**9281,2**	**9281,2**	**983,1**

		Current		Scenario 4: "Happy downstream"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	45	25	53	53	5	-854,9		983,1	128,2
	Dupont	61	50	45	58	50	50	-3	234,9	94,5		140,3
	EMS	50	22	45	49	22	22	-1	4,1	1,7		2,5
	Evonik	46	30	45	46	30	30	0	9,8	4,0		5,9
	Lanxess	46	33	45	46	33	33	0	4,6	1,9		2,7
	Salzgitter	59	37	45	56	37	37	-3	72,0	29,0		43,0
	ThyssenKrupp	46	39	45	46	39	39	0	30,6	12,3		18,3
Component suppliers	Alps	64	35	45	51	45	42	-19	274,0	110,3		163,7
	Austria Microsystems	54	30	45	51	45	35	-8	9,7	3,9		5,8
	Bekaert	74	39	45	61	45	42	-16	144,6	58,2		86,4
	Daetwyler	48	20	45	46	45	35	-17	50,3	20,2		30,0
	ElringKlinger AG	66	21	45	47	45	43	-41	136,9	55,1		81,8
	Federal Mogul	70	43	45	55	45	44	-16	241,1	97,1		144,1
	Georg Fischer	57	39	45	53	45	41	-6	55,4	22,3		33,1
	GKN	62	82	45	52	45	60	12	-269,7		310,2	40,5
	Hella	50	38	45	46	45	43	-9	138,4	55,7		82,7
	Leoni	48	63	45	46	45	52	9	-103,7		119,3	15,6
	Miba	55	35	45	49	45	41	-12	21,1	8,5		12,6
	Nidec	84	65	45	60	45	53	-11	226,0	91,0		135,0
	Polytec	39	28	45	44	45	43	-9	14,1	5,7		8,4
	Rheinmetall	82	54	45	64	45	49	-14	184,3	74,2		110,1
	Saint-Gobain	44	52	45	44	45	51	2	-198,2		228,0	29,7
	Tyco	59	30	45	51	45	39	-18	442,1	178,0		264,1
System suppliers	Schaeffler Group	55	33	35	40	45	42	-24	774,3	311,7		462,6
	Continental	60	50	35	45	45	47	-12	1138,7	458,4		680,3
	Bosch	65	29	35	47	45	38	-28	4121,2	1659,0		2462,2
	Mahle	60	34	35	41	45	42	-27	593,7	239,0		354,7
	ZF Sachs	51	46	35	36	45	45	-14	766,0	308,4		457,7
	Valeo	50	76	35	37	45	49	14	-481,1		553,3	72,2
	BorgWarner	64	70	35	42	45	51	-3	42,6	17,1		25,4
	Magna	57	52	35	41	45	47	-12	810,7	326,4		484,4
Car manufacturers	BMW	12	32	12	12	35	35	-3	625,5	251,8		373,7
	Daimler	24	29	24	24	35	35	-6	2149,2	865,1		1284,0
	VW	21	35	21	21	35	35	0	134,9	54,3		80,6
	Renault	10	59	10	10	35	35	24	-2800,7		3220,8	420,1
								TOTAL	**8742,5**	**5414,6**	**5414,6**	**8742,5**

	Scenario 5: "Long payment terms"								
	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
ArcelorMittal	50	26	53	53	6	-1024,7		1178,4	153,7
Dupont	50	59	50	50	-2	163,6	32,9		130,7
EMS	50	50	22	22	0	-0,1		0,1	0,0
Evonik	50	47	30	30	1	-27,1		31,2	4,1
Lanxess	50	47	33	33	1	-18,5		21,2	2,8
Salzgitter	50	57	37	37	-2	46,3	9,3		36,9
ThyssenKrupp	50	47	39	39	1	-99,2		114,1	14,9
Alps	52	56	50	45	-18	254,6	51,3		203,4
Austria Microsystems	52	53	50	37	-8	8,9	1,8		7,1
Bekaert	52	64	50	44	-15	136,2	27,4		108,8
Daetwyler	52	50	50	38	-16	46,7	9,4		37,3
ElringKlinger AG	52	53	50	47	-39	130,8	26,3		104,5
Federal Mogul	52	59	50	47	-15	223,1	44,9		178,2
Georg Fischer	52	55	50	43	-6	49,2	9,9		39,3
GKN	52	56	50	63	13	-297,1		341,7	44,6
Hella	52	52	50	47	-8	115,7	23,3		92,4
Leoni	52	50	50	55	11	-116,9		134,5	17,5
Miba	52	53	50	44	-11	19,0	3,8		15,1
Nidec	52	65	50	56	-10	202,4	40,7		161,6
Polytec	52	51	50	48	-8	11,4	2,3		9,1
Rheinmetall	52	67	50	52	-13	171,3	34,5		136,8
Saint-Gobain	52	45	50	52	2	-243,8		280,4	36,6
Tyco	52	55	50	42	-17	412,3	83,0		329,3
Schaeffler Group	45	47	52	47	-22	701,8	141,3		560,6
Continental	45	51	52	51	-10	970,7	195,4		775,3
Bosch	45	53	52	43	-26	3855,3	776,1		3079,3
Mahle	45	49	52	48	-24	543,8	109,5		434,3
ZF Sachs	45	45	52	52	-12	617,3	124,3		493,0
Valeo	45	46	52	55	17	-569,8		655,3	85,5
BorgWarner	45	50	52	57	0	5,8	1,2		4,7
Magna	45	48	52	52	-9	653,6	131,6		522,0
BMW	12	12	45	45	-13	2786,1	560,8		2225,2
Daimler	24	24	45	45	-16	5536,3	1114,5		4421,9
VW	21	21	45	45	-10	5421,3	1091,3		4330,0
Renault	10	10	45	45	14	-1643,4		1889,9	246,5
					TOTAL	**19042,9**	**4646,7**	**4646,7**	**19042,9**

	Scenario 6: "Short payment terms"								
	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
ArcelorMittal	25	21	53	53	1	-175,7		202,1	26,4
Dupont	25	54	50	50	-7	519,9	292,5		227,4
EMS	25	45	22	22	-5	21,1	11,9		9,2
Evonik	25	42	30	30	-4	157,7	88,7		69,0
Lanxess	25	42	33	33	-4	96,8	54,5		42,4
Salzgitter	25	52	37	37	-7	175,1	98,5		76,6
ThyssenKrupp	25	41	39	39	-5	550,2	309,5		240,7
Alps	30	41	25	28	-16	225,5	126,9		98,6
Austria Microsystems	30	45	25	28	-7	7,7	4,3		3,3
Bekaert	30	54	25	33	-13	123,7	69,6		54,1
Daetwyler	30	37	25	23	-14	41,3	23,2		18,1
ElringKlinger AG	30	34	25	25	-36	121,7	68,5		53,2
Federal Mogul	30	46	25	32	-13	196,0	110,3		85,7
Georg Fischer	30	47	25	34	-5	40,0	22,5		17,5
GKN	30	43	25	48	15	-338,2		388,9	50,7
Hella	30	35	25	28	-5	81,5	45,9		35,7
Leoni	30	37	25	40	12	-136,7		157,2	20,5
Miba	30	40	25	29	-9	15,8	8,9		6,9
Nidec	30	51	25	41	-8	166,9	93,9		73,0
Polytec	30	31	25	25	-5	7,4	4,2		3,2
Rheinmetall	30	56	25	39	-12	151,9	85,4		66,4
Saint-Gobain	30	41	25	47	3	-312,2		359,1	46,8
Tyco	30	42	25	27	-15	367,7	206,8		160,8
Schaeffler Group	35	40	30	31	-13	411,8	231,7		180,1
Continental	35	45	30	38	-3	298,8	168,1		130,7
Bosch	35	47	30	29	-19	2791,8	1570,6		1221,2
Mahle	35	41	30	31	-15	343,9	193,5		150,4
ZF Sachs	35	36	30	31	0	22,4	12,6		9,8
Valeo	35	37	30	36	27	-924,5		1063,2	138,7
BorgWarner	35	42	30	40	9	-141,0		162,2	21,2
Magna	35	41	30	35	0	25,2	14,2		11,0
BMW	12	12	35	35	-3	625,5	351,9		273,6
Daimler	24	24	35	35	-6	2149,2	1209,1		940,1
VW	21	21	35	35	0	134,9	75,9		59,0
Renault	10	10	35	35	24	-2800,7		3220,8	420,1
					TOTAL	**5042,2**	**5553,5**	**5553,5**	**5042,2**

	Scenario 7: "Bringing DSO and DPO closer together"								
	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
ArcelorMittal	45	25	53	53	5	-854,9		983,1	128,2
Dupont	45	58	50	50	-3	234,9	22,2		212,6
EMS	45	49	22	22	-1	4,1	0,4		3,8
Evonik	45	46	30	30	0	9,8	0,9		8,9
Lanxess	45	46	33	33	0	4,6	0,4		4,2
Salzgitter	45	56	37	37	-3	72,0	6,8		65,2
ThyssenKrupp	45	46	39	39	0	30,6	2,9		27,7
Alps	55	58	45	42	-12	176,9	16,8		160,2
Austria Microsystems	55	54	45	35	-5	5,6	0,5		5,1
Bekaert	55	65	45	42	-11	102,9	9,7		93,2
Daetwyler	55	52	45	35	-11	32,3	3,1		29,2
ElringKlinger AG	55	56	45	43	-32	106,5	10,1		96,4
Federal Mogul	55	61	45	44	-10	150,9	14,3		136,6
Georg Fischer	55	56	45	41	-3	24,6	2,3		22,3
GKN	55	58	45	60	18	-406,7		467,7	61,0
Hella	55	54	45	43	-2	24,6	2,3		22,3
Leoni	55	52	45	52	15	-169,6		195,0	25,4
Miba	55	55	45	41	-6	10,5	1,0		9,5
Nidec	55	66	45	53	-5	107,9	10,2		97,7
Polytec	55	53	45	43	0	0,7	0,1		0,6
Rheinmetall	55	69	45	49	-9	119,5	11,3		108,2
Saint-Gobain	55	46	45	51	4	-426,2		490,1	63,9
Tyco	55	57	45	39	-12	293,2	27,8		265,4
Schaeffler Group	60	59	55	50	-13	411,8	39,0		372,8
Continental	60	60	55	53	-3	298,8	28,3		270,5
Bosch	60	62	55	44	-19	2791,8	264,4		2527,4
Mahle	60	60	55	50	-15	343,9	32,6		311,3
ZF Sachs	60	59	55	54	0	22,4	2,1		20,3
Valeo	60	59	55	58	27	-924,5		1063,2	138,7
BorgWarner	60	61	55	59	9	-141,0		162,2	21,2
Magna	60	59	55	54	0	25,2	2,4		22,8
BMW	12	12	60	60	-28	6026,9	570,8		5456,1
Daimler	24	24	60	60	-31	10617,1	1005,5		9611,6
VW	21	21	60	60	-25	13350,9	1264,4		12086,5
Renault	10	10	60	60	-1	92,6	8,8		83,9
					TOTAL	**32570,7**	**3361,4**	**3361,4**	**32570,7**

Competitive paper

The impact of supply management innovativeness and supplier orientation on firm's sustainability performance

Katrina Lintukangas*
Lappeenranta University of Technology, School of Business and Management
P.O. Box 20, FI-53851 Lappeenranta, Finland
Email: katrina.lintukangas@lut.fi, Tel. +358 40 833 6834
*Corresponding author

Anni-Kaisa Kähkönen
Lappeenranta University of Technology, School of Business and Management,
P.O. Box 20, FI-53851 Lappeenranta, Finland.
E-mail: anni-kaisa.kahkonen@lut.fi, Tel.: +358 40 833 6582

Jukka Hallikas
Lappeenranta University of Technology, School of Business and Management,
P.O. Box 20, FI-53851 Lappeenranta, Finland.
E-mail: jukka.hallikas@lut.fi, Tel.: +358 40 550 7499

Abstract
The objective of this study is to examine whether supplier orientation and supply management innovativeness have positive impacts on a company's overall sustainability performance. This empirical study is based on a survey that targeted large- and medium-sized manufacturing companies in Finland. The results show that innovativeness in supply management considerably influences a firm's overall sustainability performance. Moreover, it is confirmed that supplier orientation positively relates to sustainability performance. The benefits of strategic supplier orientation and innovativeness of supply management are realized in sustainability performance directly. Supply management is a function where new ideas with the aim to influence supply markets are presented. For firm management recognizing this two-fold impact of supply management on sustainability performance is essential.

Keywords: Innovativeness, Supplier orientation, Sustainability performance

The impact of supply management innovativeness and supplier orientation on a firm's sustainability performance

Abstract
The objective of this study is to examine whether supplier orientation and supply management innovativeness have positive impacts on a company's overall sustainability performance. This empirical study is based on a survey that targeted large- and medium-sized manufacturing companies in Finland. The results show that innovativeness in supply management considerably influences a firm's overall sustainability performance. Moreover, it is confirmed that supplier orientation positively relates to sustainability performance. The benefits of strategic supplier orientation and innovativeness of supply management are realized in sustainability performance directly. Supply management is a function where new ideas with the aim to influence supply markets are presented. For firm management recognizing this two-fold impact of supply management on sustainability performance is essential.

Keywords: sustainability, innovativeness, supply management, supplier orientation, purchasing, supply chain

Introduction

In recent years, the movement towards innovative sustainable solutions and the adoption of cleaner technologies among companies has been evident. According to Eurostat's (2017) most recent innovation statistics, 52.7% of innovative companies in European Union (EU) member states introduced innovations with environmental benefits for the companies themselves or their customers. Hence, it seems that firms aim to improve their sustainability performance through innovations. Porter and van der Linde (1995) state that the sustainability requirements of the customers and other stakeholders force companies to innovate, which creates new business opportunities. Coping with sustainability requirements and creating innovations are closely related concepts (Eccles and Serafeim, 2013), and sustainability has been regarded as a driving force that increases the innovativeness of firms and supply chains (Porter and van der Linde, 1995; Nidomolu et al., 2009). Innovativeness is perceived as a prerequisite to the adoption of sustainability practices (Pagell and Wu, 2009), and it increases the utilisation of sustainable processes in supply management (Gualandris and Kalchschmidt, 2014). The growing requirements of sustainability also enhance the innovativeness of the entire supplier network (Nidumolu, Prahalad and Rangaswami, 2009), and sustainable innovations arise from supply chains where suppliers aim to satisfy their customers' needs. Thus, innovativeness and sustainability form a self-feeding cycle because on one hand, organisations need innovation capabilities to exploit sustainability; on the other hand, sustainability drives organisations to innovate. Thus, to gain the business benefits of the investments in sustainability, a company needs to enhance its own innovation capability, as well as utilise the innovativeness of its suppliers.

Supply management operates in the intersection of a company and its suppliers; therefore, supply management's participation in early phases of innovations, especially in terms of sustainability, is important (Hallstedt, Thompson and Lindahl, 2013). According to Hollos, Blome and Foerstl (2012), a company can have a strategic orientation towards suppliers in its upstream supply chain, which considerably enhances supplier co-operation in sustainability matters. This

strategic supplier orientation of a firm and the integration of interfirm capabilities of buyers and suppliers can increase innovativeness in supply chains (Hollos et al., 2012). Suppliers' ability to provide sustainable solutions and the development of integrated solutions in supply chains may also generate value, in terms of both sustainability and successful businesses (Windahl and Lakemond, 2006). According to Pulles, Veldman and Schiele (2014), suppliers' professionalism, specialisation and collaborative attitude, together with the characteristics of buyer-supplier relationships, such as supplier development programmes and buyers' status as preferred customers, increase innovativeness. Moreover, research has shown examples of innovations achieved through collaboration and partnerships (Darnall, Jolley and Handfield, 2008), and intensive buyer-supplier collaboration promotes interfirm learning and innovative ideas (Sofka and Grimpe, 2010). Overall, cross-organisational integration is a critical issue that should be connected to innovations (Rizzi, Bartolozzi, Borghini and Frey, 2013).

However, the more deeply suppliers are integrated into product design, the less visible the innovation process becomes from the buyers' perspective (Petersen, Handfield and Ragatz, 2005). Bönte and Dienes (2013) argue that companies following a co-operation strategy do not have higher environmental innovation performance. Consequently, there are contradictions in scientific discussions on the effects of inter-organisational collaboration on innovations, sustainability and performance. The existing research examining the connections between innovativeness and sustainability is still rare and mainly at a conceptual level (Gualandris and Kalchschmidt, 2014). Therefore, more research is needed to clarify the possible links between these concepts. This study's objectives are to clarify the meaning of supply management innovativeness, examine how it may affect a firm's sustainability performance, as well as how a firm's supplier orientation may contribute to its sustainability performance. Consequently the main research question in this study is: *What is the effect of firm's supplier orientation and supply management innovativeness on firm's overall sustainability performance?* The links between the concepts and their possible influence on a company's sustainability performance are examined by utilising the survey data collected from 113 Finnish firms in several industries. In the following section, the concepts are clarified, and several hypotheses based on the existing literature are developed. The methodological section follows. Finally, the results are discussed, and the conclusions are presented.

Theoretical background and hypotheses

A firm's sustainability performance

The increased sustainability awareness of a firm and its stakeholders has induced the company owners and management to consider how to create value from sustainability and to do so in a viable manner. If a company can create value and generate profit by utilising sustainable processes in its supply chains, it will strive for feasible strategies and business benefits. According to Waddock and Graves (1997), corporate social performance is associated with financial performance. Companies with strong financial performance are more conscious about or have more financial resources to spend on resolving sustainability issues (Waddock and Graves, 1997). Accordingly, it is acknowledged that a firm's size may influence its adoption of sustainability practices (Zhu et al., 2008). Large firms with high brand equity more likely implement sustainability practices and collaborate within their respective industries and with nongovernmental organisations (Plambeck, Lee and Yatsko, 2011). However, it is difficult to overstep the boundaries of a firm and dictate the sustainability rules to suppliers in upstream supply

chains. Thus, powerful companies should be role models (Amaeshi, Osuji and Nnodim, 2008) and use their strengths to boost the capabilities of weaker parties in the supply chain through education and collaborative value creation.

Improvement of corporate environmental and social performance requires clear actions, such as formulating strategies and designing and developing systems of sustainable performance. (Epstein and Roy, 2001). According to Montiel (2008), the main body of the corporate social responsibility (CSR) and sustainability studies builds on social, economic and environmental elements. While there are arguments that these three elements are actually interdependent, the majority of the empirical studies treat these dimensions as independent components and concentrate on a particular component (Montiel, 2008). The connection between sustainability performance and financial performance has been found, but only environmental performance has a direct effect on financial performance (Wagner, 2010), whereas the impact of social performance is moderated by advertising intensity. Additionally, by being a first mover in the market in terms of creating sustainable business cases, a firm can enhance its market share and image (Paulraj, 2011).

Although sustainability performance measurement is an essential part of corporate performance management, it has received little research attention (Searcy, 2012; Schaltegger and Burritt, 2014). The traditional way to measure firm performance only by means of financial and economic factors prioritises profits over people and the planet (Elkington, 1998). In terms of sustainability performance, the actions of the upstream supply chain should also be counted (Montabon, Pagell and Wu, 2016). The role of supply management is to prevent or mitigate sustainability-related risks by applying supplier selection, control and purchasing practices that ensure a company's sustainability efforts. Thus, the success of a firm's sustainability highly depends on its supply management, and it has been found that supply management directly and positively affects a company's sustainability performance (Gualandris, Golini and Kalchschmidt, 2014).

Innovativeness in supply management

Innovation is a largely examined concept in many studies, as Crossan and Apaydin's (2010) comprehensive literature review points out. According to Damanpour (1996, p. 694), "innovation is conceived as a means of changing an organization, either as a response to changes in the external environment or as a preemptive action to influence the environment. Hence, innovation is here broadly defined to encompass a range of types, including new product or service, new process technology, new organization structure or administrative systems, or new plans or program pertaining to organization members". Baregheh, Rowley and Sambrook (2009, p. 1334) complement the definition to consider business and company success as a main driver of innovations by arguing that "innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace". Crossan and Apaydin (2010, p. 1155) summarise innovation "[as] both a process and an outcome". For example, the existence of innovation capability and resources in a company, the detection of a market opportunity, business environment uncertainty and changes that force firms to innovate are found to be the drivers of innovations (Grossan and Apaydin, 2010).

Innovativeness refers to a company's collective openness to new ideas embedded in the corporate culture (Hurley and Hult, 1998). The company's ability to produce or adapt to new innovations, with the aim of influencing the markets where it operates, reflects its level of corporate innovativeness (Garcia and Calantone, 2002). According to Calantone, Cavusgil and

Zhao (2002), a firm's innovativeness can be measured by the frequency of activities through which the company tries out new ideas, seeks novel operating procedures, develops its operations creatively and succeeds in being the first to market new products and services. Innovativeness as a company's intra-organisational capability has been found to be one of the key antecedents of business performance and competitive advantage (Burns and Stalker, 1961; Porter, 1990; Hult, Hurley and Knight, 2004; Prahalad and Krishnan, 2008). Hence, a company's ability to introduce innovations can determine its future success and survival. In line with the works of Hurley and Hult (1998), Calantone et al. (2002) and Carcia and Calantone (2002), *innovativeness in supply management* can be defined as purchasing professionals' collective ability to innovate and their openness to new ideas, with the aim of influencing supply markets.

Christmann (2000) states that innovative organisations will be leaders in sustainability. The differentiation of products and services through contributions to the reduction in the unsustainability or the increase in the sustainability of the economy and society requires product development, product or service system innovations and value chain redesigns, which are led by sustainability criteria (Schaltegger and Burritt, 2014). The implementation of sustainability practices often leads to increased process innovations, and the innovative behaviour of employees creates greater organisational support (Hollos et al., 2012). Pagell and Wu (2009) find that organisational capability to innovate is a precursor of successful and sustainable supply chain management. They add that managerial orientation is the other organisational attribute that is a precursor of sustainable supply chain management, which means that firms need to be proactive and committed to ensure sustainability in their actions.

According to Gualandris and Kalchscmidt (2014), innovativeness increases the utilisation of sustainable processes in supply management. Pagell and Wu (2009) state that innovativeness is a prerequisite of the adoption of sustainability practices. Van Bommel (2011) argues that the capability to design sustainability strategies and approaches depends on a company's innovation power and supply network. Based on these views, the first hypothesis is proposed:

H1. Innovativeness in supply management positively influences a firm's sustainability performance.

Supplier orientation

Relatively enduring patterns of strategic behaviour that actively align a firm with its environment can be understood as its strategic orientation (Miles and Snow, 2003). Many studies have shown that a firm that successfully pursues a specific orientation will demonstrate better performance (Ruekert, 1992; Baker and Sinkula, 1999; Langerak, 2001), and a strategic orientation has been considered a firm's competitive edge. Strategic orientation defines a company's interaction and fit of its strategic choices towards its external resources, environment, competitors and customers (Zhou and Li, 2010). Companies choosing a specific strategic orientation to enhance their competitive advantage and performance must have adequate capabilities to implement the strategy in practice.

Mentzer et al. (2001, p. 7) state that one of the core characteristics of the philosophy of supply chain management is "a strategic orientation toward cooperative efforts to synchronize and converge intrafirm and interfirm operational and strategic capabilities into a unified whole". Hollos et al. (2012, p. 2974) define the strategic orientation of supply management as "the function's integration in strategic planning, its knowledge of and contribution to corporate strategic goals and the visibility of its contribution to these goals". Shin, Collier and Wilson (2000, p. 318) describe

supply management orientation as involving "management efforts or philosophy necessary for creating an operating environment where the buyer and supplier interact in coordinated fashion". In line with these definitions, in this study, strategic orientation is regarded as *supplier orientation*, that is, a firm's effort to co-operate with its suppliers by aiming for a strategic fit regarding its choices of external resources in the upstream supply chain. Hence, supplier orientation refers to the organisational activity of managing supplier relationships to achieve the firm's goals, and it is considered one of the possible strategic orientations of a firm.

Shin et al. (2000) find that supply management orientation constitutes a long-term orientation to supplier relationships, supplier involvement in product development, a reduced number of suppliers, and a quality focus. Min and Mentzer (2004) and Miocevic and Crnjak-Karanovic (2012) state that credibility, benevolence, commitment, norms, compatibility and top management support comprise supply chain orientation. Hollos et al. (2012) include adaptation to changing business plans, long-range planning and profound knowledge in their measurement of supply management orientation. Moreover, a firm's strategic orientation towards purchasing and supply management has a positive impact on sustainable supplier co-operation (Hollos et al., 2012). The firm's supplier base largely defines the level of sustainability of both the firm and the entire supply chain (Grosvold, Hoejmose and Roehrich, 2014). Bai and Sarkis (2010) argue that commodity- and price-based supplier relationships are no longer acceptable to suppliers of critical materials or organisations seeking to introduce innovative supply management, especially when the focus is on sustainability concerns. Thus, collaborative buyer-supplier relationships and strategic orientation towards suppliers need to be connected to a company's sustainability strategy. Based on this argument, the second hypothesis is proposed:

H2. Supplier orientation positively influences a firm's sustainability performance.

Interaction effect of supply management innovativeness and supplier orientation on sustainability performance

Buyer-supplier collaboration and supplier involvement in product development projects are widely studied research streams (Hoegl and Wagner, 2005; van Echtelt, Wynstra, van Weele and Duysters, 2008). However, mixed results about their influence on company performance or the success of product development have been presented (Wynstra, van Weele and Weggeman, 2001). Azadegan and Dooley (2010) show that suppliers' innovativeness (as the capacity to develop and introduce new products and processes) is positively associated with the buyer's manufacturing performance. Companies are increasingly utilising external sources of innovation management; thus, knowledge is needed about which suppliers are able to contribute to the firms' innovativeness (Schiele, 2006). Collaboration with suppliers has also been found as one of the best ways to enhance the transparency of supply chains and to mitigate sustainability-related risks (Multaharju, Lintukangas, Hallikas and Kähkönen, 2017). Therefore, companies should recognise the innovation potential of their suppliers and aim for collaborative and long-term business relationships with them to create value for both and finally, for the end customer.

Innovations linked to supply management have been studied in terms of collaborative actions between buyers and suppliers, such as early supplier involvement (e.g., Petersen et al., 2005; Johnsen, 2009) and supplier orientation (Kähkönen, Lintukangas and Hallikas, 2015). Early supplier involvement more likely occurs in collaborative than in arm's-length relationships (Bidault, Despres and Butler, 1998), and trust in suppliers has been found to increase innovativeness in supply chains (Panayides and Lun, 2009). The organisations' ability to manage

these collaborative operations and knowledge further increases innovations (Soosay, Hyland and Ferrer, 2008). Firms' supply management needs to participate in early phases of innovations, especially in terms of sustainability (Hallstedt et al., 2013). Sustainability-related risks and opportunities have spurred sustainability-oriented innovations in an increasing number of industries and markets and have become major competitive drivers among companies (Schaltegger and Burritt, 2014). The impact of supply chain innovativeness on supply chain performance has also been found to be mediated by supply chain integration (Seo, Dinwoodie and Kwak, 2014). Thus, it seems that supply management innovativeness and supplier orientation might be intertwined, and it is reasonable to study possible interaction effects of these two concepts on sustainability performance. Moreover, according to Russo and Fouts (1997) and Pullman, Maloni and Carter (2009), it is difficult to define the causality and the relationship between intangible resources, such as sustainability, and performance outcomes. Therefore, the third hypothesis is proposed:

H3. There is an interaction effect of supplier orientation and supply management innovativeness on sustainability performance.

Figure 1 presents the hypothesised model of the study.

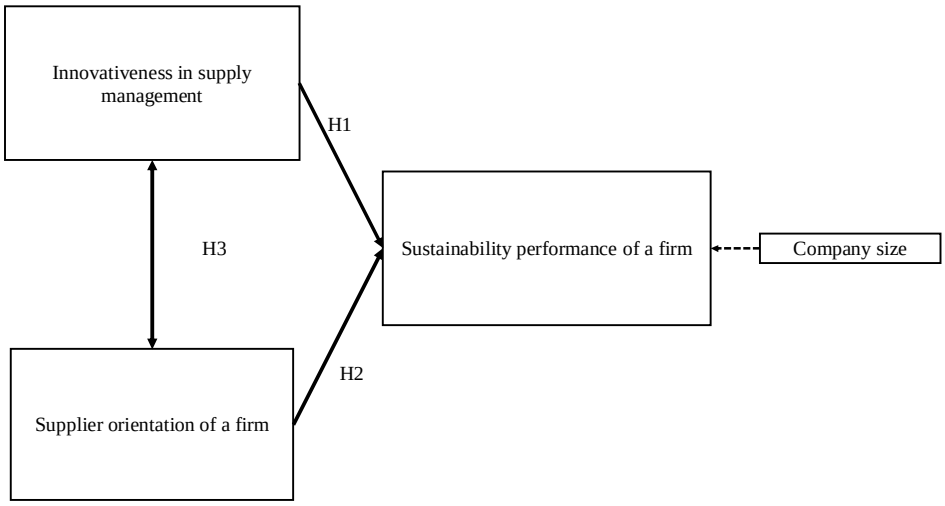

Figure 1. Research model.

Methodology

Data and sample

The objective of this study is to examine if supplier orientation and supply management innovativeness are connected to a company's overall sustainability performance. According to Creswell (2014), quantitative methods are the appropriate choices in empirical studies examining the relationships between concepts or the influence of drivers on an outcome. Therefore, a survey was designed to perform a quantitative analysis and to increase the generalisability of the results. The empirical study is based on a survey that targeted large- and medium-sized manufacturing and logistics companies in Finland. The choice of Finnish companies is justified because regarding investments in new technologies covering the 2012–2014 period, the share of novel sustainable innovations and technologies adopted in Finland's manufacturing industry was 71%, and the

service sector accounted for 50% (Official Statistics Finland, 2016). Moreover, the country's renewed innovation policy (Organisation for Economic Co-operation and Development, 2017) encourages Finnish companies to innovate in terms of sustainability by stating that coping with challenges in adapting to technological changes caused by sustainability, such as energy efficiency, water constraints, health issues and green growth, should become a permanent feature of firms' strategies. Hence, the Finnish context fits the research focus.

Firms with at least 30 million euros in operating capital, 100 employees and activities in Finland were extracted from the commercial AMADEUS (Bureau van Dijk) database. The sample consisted of 387 firms. All these companies were first contacted by phone to find the most suitable informants in the field of supply management, and the web link to the questionnaire was emailed to them. Reminder emails were sent to those who had not answered within two weeks. Finally, 113 filled-in questionnaires were received, with a response rate of 29.2% (113/387). However, the screening of the returned forms revealed two incomplete and non-usable questionnaires, which were removed from the data file, resulting in 111 usable responses for quantitative analysis. The non-response bias was assessed by comparing the early and the late respondents (Armstrong and Overton, 1977) in terms of industry, turnover and number of employees. Because no significant differences were found, it was concluded that non-response bias was not a concern in the data.

Of the respondents, 32% represented top management, 46% belonged to middle management, 4% occupied operative positions, 17% were experts in the field, and 1% held other positions. On average, the share of turnover expenses was 53%. Of all the purchases, 35% were manufactured abroad (11% of those came from low-cost countries) and on average, were sourced from 14 countries. The responses were grouped into six main industry categories, including construction; manufacturing of machinery, equipment, metal, non-metal, plastic and electronic products; chemical, paper and wood; logistics services; food; and other industries. Table 1 presents the basic information about the respondent companies.

Table 1. The sample's numerical data.

Industry	**N**	**Turnover (t€)**	**Employees**
Construction	23	176 521	458
Machinery, equipment and industrial manufacturing	39	388 969	1 696
Chemical, wood and paper	18	1 269 497	3 223
Logistics services	18	99 117	189
Food	4	613 046	1 371
Other	9	137 322	618
Total	111	428 404	1 344

Variables

Previous studies found that a company's size influenced its adaptation to sustainability practices (e.g., Zhu et al., 2008); therefore, the *firm's size* was included in the model as a control variable. The firm's size was measured by using the operating revenue of each respondent company. Logarithmic transformation was used to normalise the variable to meet the assumptions of regression analysis. The company's *sustainability performance* was assessed by asking the respondents to evaluate their current level of sustainability performance with six statements concerning reporting, organising, strategy and communication on 7-point Likert scale (from 1 = extremely low success to 7 = extremely high success). The *innovativeness in supply management*

measurement was based on the studies of Hurley and Hult (1998), Panayides and Lun (2009) and Seo et al. (2014). Six statements were provided regarding innovation capability in supply management, processes and operation models to collect ideas about supplier networks, participation in the company's innovation processes and coordination/facilitation of new ideas. To measure *supplier orientation*, the scale applied in the study of Kähkönen et al. (2015) was used. Table 2 shows the components, items and loadings.

Table 2. The items, loadings and reliability of the variables in this study.

Rotated Component Matrix	**1**	**2**	**3**
Supplier orientation (Kähkönen et al., 2015), α = 0.910			
Supplier collaboration is measured regularly.	0.822	0.118	0.180
In supplier relationships, there are clear procedures concerning errors.	0.789	0.051	0.143
The supplier relationships have clear and concrete objectives.	0.784	0.104	0.101
The supplier relationships are identified and categorised.	0.76	0.169	0.098
Business processes are developed jointly with suppliers.	0.758	0.099	0.245
The measurement criteria for supplier collaboration are jointly agreed upon.	0.751	0.231	0.247
Joint strategic planning is included in supplier relationships.	0.718	0.160	0.203
New areas of collaboration are actively sought with suppliers.	0.697	0.095	0.179
Sustainability performance, α = 0.898			
Sustainability is performed together in the whole organisation.	0.205	0.875	0.141
Our company takes care of organising and managing sustainability issues.	0.247	0.87	0.131
Our company takes care of the control and reporting of sustainability issues.	0.196	0.86	0.042
We act according to a sustainability strategy and vision.	0.157	0.83	0.141
Sustainable actions are seen in the results of the business.	0.001	0.794	0.127
We actively communicate with end customers about sustainability values.	0.074	0.74	0.137
Innovativeness in supply management, α = 0.914			
The purchasing process supports finding innovative solutions.	0.202	0.015	0.824
Supply management participates in the innovation processes of a company.	0.151	0.130	0.823
The capability to innovate in supply management is systematically developed.	0.254	0.210	0.762
Goals and measures related to innovations are set for supply management.	0.147	0.240	0.719
The collaboration between supply management and research and development is seamless.	0.141	-0.019	0.706
Supply management coordinates and facilitates new ideas in the organisation.	0.255	0.233	0.675

Extraction method: principal component analysis
Rotation method: Varimax with Kaiser normalisation

To examine the unidimensionality of the model variables, a principal component analysis (PCA) with Varimax rotation was performed. The Kaiser-Meyer-Olkin (KMO) measure with a value of

0.879 confirmed the suitability of the items for PCA. A three-component solution was suggested, explaining 66% of the total variance. The reliability of the suggested scales was checked by calculating Cronbach's alphas. Composite measures were formed from each of the components. Table 3 presents the correlations among the composite variables.

Table 3. Correlations among the composite variables.

Variables (N = 111)	Mean	Standard Deviation	1	2	3	4
1. Sustainability performance	4.835	1.143	1.000			
2. Supplier orientation	4.866	1.150	0.359**	1.000		
3. Supply management innovativeness	4.072	1.140	0.348**	0.475**	1.000	
4. Turnover (ln)	11.351	1.472	0.154	0.072	-0.080	1.000

**p < 0.01

Regression analysis and results

The regression analysis (SPSS software) was performed to test the hypotheses. However, the small number of respondents (N = 111) did not make it possible to include the industry dummies (six different dummy variables) in the regression model. Therefore, the influence of the industry was checked separately by performing a one-way ANOVA analysis. The results showed no evidence that industries differed in terms of sustainability performance, innovativeness in supply management and supplier orientation ($p < 0.05$).

The regression analysis was performed in three phases. In the first phase (Model 1), only the control variable firm's size was included, and the results showed that it had no significant effect on sustainability performance ($R^2 = 0.024$). In the second phase (Model 2), the linearity of supplier orientation and innovativeness in supply management regarding each firm's sustainability performance was tested. The result was significant ($R^2 = 0.194$, $p < 0.01$). Third (Model 3), the interaction effect was included in the analysis. The interaction term was calculated by multiplying the variables supplier orientation and innovativeness in supply management. For the analysis, these interaction variables were standardised to prevent the possible problem of multicollinearity, which is common when testing the interactions between the independent variables. It turned out that the R^2 of change (0.013, Sig. of change =0.185) between Models 2 and 3 was not significant; therefore, no interaction effect was found.

To test for multicollinearity, the values of the variable inflation factor (VIF) scores were examined. The highest value was 1.403, which was clearly less than the cut-off level suggested by Cohen et al. (2003). The residuals of the regression varied between -3.22 and 1.79, showing that heteroscedasticity was not a problem in this case. The normality of the variables was estimated graphically from scatter figures. No violations of the assumptions of regression analysis were found, and it could be concluded that the test was performed successfully.

Based on the analysis, it can be concluded that innovativeness in supply management positively influences a firm's sustainability performance, as proposed in Hypothesis 1. Hypothesis 2, suggesting that supplier orientation positively influences a firm's sustainability performance, is supported as well. However, the argument in Hypothesis 3 is not supported. The interaction term does not provide significant improvement in the model, and thus, the proposed interaction effect of supplier orientation and innovativeness in supply management on sustainability performance is not detected. Moreover, in line with the results of the study of Zhu et al. (2008), it is found that a

company's size and sustainability performance are connected (Standardised $\beta = 0.167$; $p < 0.1$). Table 4 summarises the regression results.

Table 4. Results of regression analysis.

Model	Coefficients	Unstandardised Coefficients		Standardised Coefficients	t-value	Sig.
		Beta	Std. Error	Beta		
1	(Constant)	3.478	0.841		4.136	0.000
	Turnover (ln)	0.120	0.073	0.154	1.627	0.107
2	(Constant)	1.314	0.896		1.466	0.146
	Turnover (ln)	0.122	0.068	0.158	1.796	0.075*
	Supplier orientation	0.252	0.100	0.252	2.529	0.013**
	Supply management innovativeness	0.227	0.099	0.229	2.299	0.023**
3	(Constant)	1.078	0.911		1.184	0.239
	Turnover (ln)	0.130	0.068	0.167	1.907	0.059*
	Supplier orientation	0.233	0.100	0.233	2.324	0.022**
	Supply management innovativeness	0.262	0.102	0.263	2.571	0.012**
	Orientation x Innovativeness	0.128	0.096	0.120	1.333	0.185

Dependent variable: sustainability performance

Model	R	R Square	Adjusted R Square	F value	Sig.
1	0.154	0.024	0.015	2.648	0.107
2	0.440	0.194	0.171	8.576	0.000***
3	0.455	0.207	0.177	6.923	0.000***

***p < 0.1; **p < 0.05; ***p < 0.01**

Discussion and conclusions

In this paper, the connections of supply management innovativeness and supplier orientation to a firm's sustainability performance has been examined. This paper's main contribution is finding and detecting the link between innovativeness and sustainability and between supplier orientation and sustainability. Innovativeness in supply management has been found to have a direct and positive influence on a company's sustainability performance (Unstandardised $\beta = 0.262$; Sig. = 0.012). A firm's supplier orientation also has a positive effect on sustainability performance (Unstandardised $\beta = 0.233$; Sig. = 0.022). However, there is no interaction effect between supply management innovativeness and supplier orientation on a firm's sustainability performance. Additionally, the results confirm that a firm's size influences sustainability performance, showing that large companies perform better in terms of sustainability than smaller ones. This finding is in line with those of Zhu et al. (2008) and Plambeck et al. (2011), who report that large firms and firms with high brand equity more likely adopt sustainability practices, which further contribute to their sustainability performance.

In Hypothesis 1, it is proposed that innovativeness in supply management positively influences a firm's sustainability performance. Several previous studies discuss about the critical role of the supply management function in a company's research and development and innovation

development; the benefits of cross-functional collaboration between product development and supply management are also widely acknowledged (e.g., Hallstedt et al., 2013; Rizzi et al., 2013). However, to the best knowledge of this paper's authors, there is no previous conceptualisation of what is understood as innovativeness in supply management. In this study, supply management innovativeness is defined as purchasing professionals' collective ability to innovate and their openness to new ideas, with the aim of influencing and developing supply markets. Several studies have pointed out the impact of innovativeness on supply chain performance (Panayides and Lun, 2009; Seo et al., 2014) and the sustainability of a supply chain (Gualandris and Kalcshmidt, 2014). However, in this study, innovativeness in the supply management function is defined and found to be linked to a company's overall sustainability performance. This finding supports the arguments that sustainability and innovativeness are linked, as suggested by Eccles and Serafim (2013), and that increased innovation capability may enhance a firm's sustainability performance, as suggested by Pagell and Wu (2009) and Van Bommel (2011). Innovativeness in supply management increases not only the supply chain performance but a firm's sustainability performance as well.

Hypothesis 2 suggests that supplier orientation positively influences a firm's sustainability performance. This hypothesis is supported by the empirical findings and is in line with the study of Hollos et al. (2012), who show that a strategic orientation contributes environmental and social sustainability practices. The present study's results enhance this view by showing the direct link of supplier orientation (as a firm's strategic orientation) with sustainability performance. In this study, supplier orientation is defined as a firm's effort towards co-operation with its suppliers and aim for a strategic fit regarding its choices of external resources in the upstream supply chain. In the long term, supplier orientation can have positive implications for company success and can provide competitive advantage by contributing to the development of sustainable business.

The proposed interaction effect of supplier orientation and supply management innovativeness on sustainability performance is not detected, as suggested in Hypothesis 3. This result contradicts those of previous studies that present the links between supplier collaboration and sustainability-related risk management and innovativeness in supply chains (Schaltegger and Burritt, 2014; Seo et al., 2014). However, the result supports the study of Kähkönen et al. (2015), who find that early supplier involvement and interfirm learning are concepts where innovation-related actions in supply management increase a buyer's dependency on its suppliers, whereas supplier orientation is a strategy for value-creating collaboration. Hence, the benefits of strategic supplier orientation and innovativeness in supply management are directly realised in sustainability performance without interaction.

Based on this study's findings, it can be concluded that supply management plays a vital role in boosting a firm's overall sustainability performance. This must be understood when formulating a company's CSR strategies and implementing sustainable values in practice. Supply management is not only a gatekeeper against sustainability risks arising from the supply base but is also a function where new ideas that aim to influence supply markets are presented. For a firm's management, it is essential to recognise this twofold impact of supply management on sustainability performance.

The results also show that if companies search for improvements in their sustainability performance, supply management innovations seem to be significant drivers. Companies seem to adopt sustainability requirements in their purchases to find innovative solutions as well. This implies that goals and measures related to innovations should be connected to the sustainability requirements set for suppliers. Consequently, it can be anticipated that sustainability performance

in purchasing and supply management can be improved by tightening sustainability requirements that foster innovations in supply management.

Similar to all research, this study has some limitations as well. The sample size is relatively small and only consists of Finnish companies. Therefore, more empirical research in other contexts is required. Moreover, the use of single informants in the data collection involves the risk of the common method bias. The study's cross-sectional design also means that the causal relationships are difficult to define. Furthermore, the relatively low explanation power (R^2 of 0.207) of the model clearly indicates that other factors can influence a firm's sustainability performance.

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Development and the first test of a system for strategic category management in purchasing

Harri Lorentz
University of Turku, Turku School of Economics, Rehtorinpellonkatu 3, 20500 Turku, Finland, harri.lorentz@utu.fi, Tel. +358 50 502 7087

Kalle Väänänen
University of Turku, Turku School of Economics, Rehtorinpellonkatu 3, 20500 Turku, Finland

Jagjit Singh Srai
Institute for Manufacturing, University of Cambridge, 17 Charles Babbage Road, Cambridge, CB3 0FS, United Kingdom, jss46@cam.ac.uk

Abstract
The aim of this paper is to develop and describe the results of initial testing of a design for a strategic category management system. We align our research process with the constructive research approach. First, we develop an initial system with three phases based on design principles identified from the literature. Second we test the initial system with a group of purchasing professionals, and conduct a simple solution-market test. As future research, we suggest further iterative development for construct refinement, with stronger solution-market tests.

Keywords: category management, purchasing, strategy, constructive research

Introduction and research question

Although several strategic portfolio models and their variants have been suggested in the PSM literature (e.g. Kraljic, 1983; Olsen and Ellram, 1997; Nellore and Söderquist, 2000; Pagell et al., 2010; Luzzini et al., 2012; Drake et al., 2013; Cox, 2015), with the most notable ones subjected to extensive testing (e.g. Caniels and Gelderman, 2007; Terpend et al., 2011; Padhi et al., 2012), there are very few attempts to define and describe the strategic category management process more comprehensively, especially through a rigorously applied scientific process, and with a broader evidence-base (cf. O'Brien, 2012; Carlsson, 2015). The most notable exception is the work of Hesping and Schiele (2015), who propose a model with five levels of strategy development in purchasing, based on the strategic alignment -focused work by González-Benito (2007). The process starts from firm and functional level strategies, suggests alignment of category strategies, and focuses on the implementation of category strategies via a set of sourcing levers (Schiele, 2007, Schiele et al., 2011; Hesping and Schiele, 2016). Despite its theoretical foundations, the proposed model lacks testing in real-life contexts.

In order to lead the development of systems for category management, academic research must seek to enable the rigorous design of the 'artificial' (Simon, 1996), i.e. objects that do not yet exist, also for category management. In such design research oriented set-ups, the main question is about whether the suggested designs work, and the aim is to 'produce knowledge that is both actionable and open to validation' (Romme, 2003). In other words, the mission of design science is to develop knowledge for solving field problems (Denyer et al., 2008), which in our case would be related to how to design a strategic category management system for PSM, or what should be the design of such a system?

For addressing this research question, we align our research process with design science, and explicitly with the constructive research approach as suggested by Kasanen et al. (1993). The constructive approach involves phases, applied in varying order: (1) find a practically relevant problem which also has research potential, (2) obtain a general and comprehensive understanding of the topic, (3) innovate or construct a solution idea, (4) demonstrate that the solution works, (5) show the theoretical connections and the research contribution of the solution concept, (6) examine the scope of applicability of the solution (Kasanen et al., 2013). In line with this approach, we develop a construct for strategic category management (i.e. a set of 'models, diagrams, plans' and processes; Kasanen et al., 1993, 243), by obtaining a comprehensive understanding of the topic through reviewing the extant literature for identification of system design principles, and by innovating and constructing an initial system with practitioner engagement. We also conduct a first solution-market test for the construct, conducted in a management training context.

Development of the initial system

According to Rumelt (2011, 6), strategy can be defined as 'a coherent set of analyses, concepts, policies, arguments, and actions that respond to high-stakes challenge', with the 'kernel of strategy' comprising of diagnosis, guiding policies, and coherent action. From this it may be extrapolated that strategizing in PSM should follow the basic cycle of diagnosis, guiding policy analysis, as well as planning and implementing coherent action, and that such a cycle should first and foremost take place at the level defined by the basic unit of analysis for strategizing in PSM, namely the purchase category (Luzzini et al., 2012; Ateş et al., 2015). A strategic category management system design, according to this first principle, would allow a category manager to sense needs to reconfigure and transform, and further to seize opportunities to sustain and improve performance at the category level in a dynamic business and supply environment (cf. Teece et al., 1997).

Here we describe the required steps in each of these phases of strategizing. The development of the initial system is based on both the extant literature and practitioner engagement (Figure 1), as the system was developed together with an experienced procurement professional.

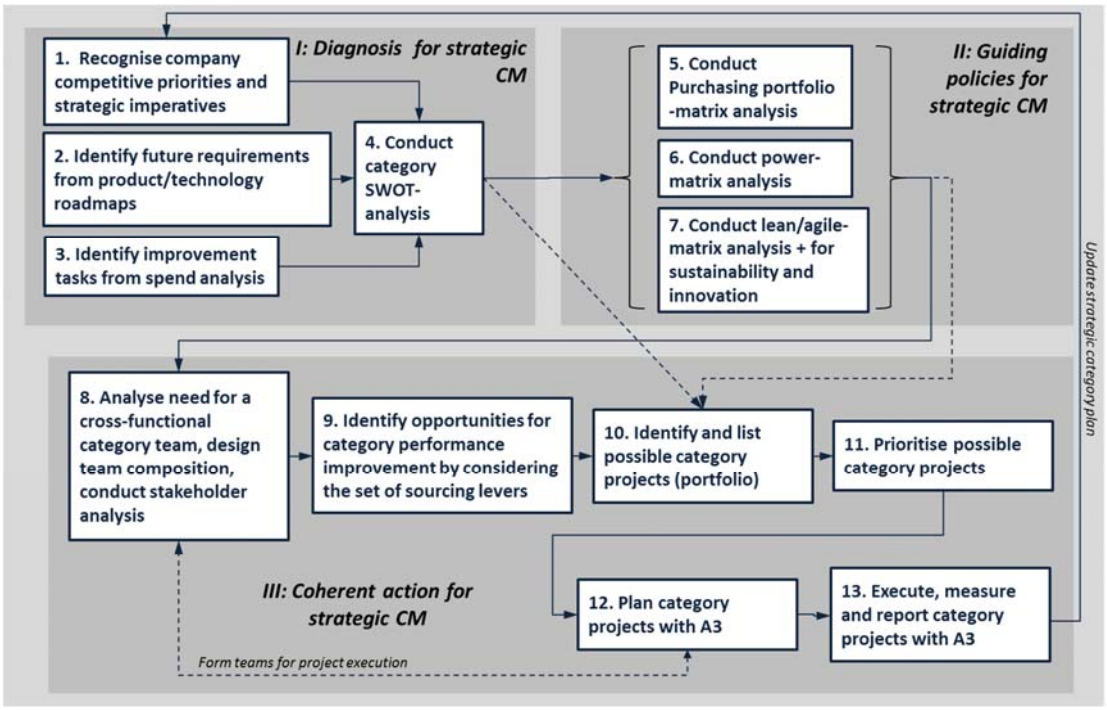

Figure 1 Initial system for strategic category management

The content of the diagnosis phase should aim to identify any challenges regarding the category (cf. Rumelt, 2011). The most high-level challenge for PSM could be suggested to be the problem of how to create value for the internal and the end-customer (cf. Amit and Zott, 2001)? The challenge of alignment between the competitive priorities of the company and the PSM function (Krause et al., 2001), has been discussed early on in the literature (e.g. Treleven and Schweikhart, 1988; Narasimhan and Carter, 1998), with evidence showing that strategic alignment of business strategy with purchasing strategy, as well as the alignment of purchasing strategy with purchasing practices, i.e. purchasing efficacy, is important for improving business performance (González-Benito, 2007; Baier et al., 2008). Therefore, we include element 1, i.e. the recognition of the competitive priorities and any strategic imperatives in the firm, into the initial system, enabled by for example a SWOT-analysis conducted at the company level. Element 2, identifying future requirements, may draw on available product and technology roadmaps (e.g. Phaal et al.). Element 3 draws on a spend analysis for identifying any challenges related to current procurement practices. In our system, we suggest that a key element in the diagnosis phase is a category level SWOT-analysis (element 4), which draws on the previously identified elements for identifying any issues and ensuring alignment, and essentially allows the brainstorming and identification, or diagnosis, of category challenges that may be addressed in the light of guiding policies or directly through coherent action.

We may conclude that the most high-stakes challenge for PSM is achieving alignment at the essential level of PSM strategizing, i.e. the purchase category. Value may be created by alignment in three respects: (1) in terms of strategic alignment with competitive priorities (e.g. quality, cost, time, flexibility, innovation, sustainability; Krause et al., 2001; Schneider and Wallenburg, 2012), (2) in terms of requirement alignment with category characteristics (e.g. profit impact, share of total cost, quality and logistics requirements; e.g. van Weele,

2010) and (3) in terms of supply market alignment with characteristics of the factor markets (e.g. supplier or buyer power, market structure; e.g. Kraljic, 1983; Cox, 2015).

What kind of guiding policies are offered for the proposed three-dimensional alignment? Selecting the Kraljic's (1983) matrix for requirement and supply market alignment (element 5), the power matrix of Cox (2015) for further supply market alignment (element 6), and the Drake et al. (2013) –matrix for strategic alignment (element 7), we may have three guiding policies for a category that should be jointly considered for a set of coherent actions (Figure 1). For example, an imaginary alignment analysis for the indirect category of office supplies, may suggest such guiding policies as 'noncritical items' (Kraljic, 1983), 'market / independence' (Cox, 2015), and 'non-strategic items' (Drake et al., 2013), and implying such coherent actions as (1) standardization, efficient processing and inventory optimization, (2) development of competence for bidding and negotiation, and (3) efficient purchasing, complexity reduction, standardization, automating transactions and using simple source selection processes to govern relatively short contracts, respectively. The recommended coherent actions seem similar, and the benefit of going through a process of using three separate analytical frameworks is not readily apparent. However, the benefits of more complex analysis are realized when there are imbalances of power, and more demanding or specific requirements from the business and internal customer. For example, the buyer may not be an attractive customer for the suppliers (van Weele, 2010), for example due to low volumes, and suppliers may have power resources over the buyer, for example due to buyer's switching costs, suggesting a dependency of the buyer, with supplier dominance (Cox, 2015). In effect, the Kraljic (1983) matrix may suggest a leverage strategy, but based on the power-matrix analysis, PSM may have to consider ways to reduce supplier's power resources or increase its own, for example by opting for a smaller supplier. Furthermore, if the competitive priorities of the company or internal customer requirements emphasize rapid design changes and short delivery times, i.e. agile supply (Drake et al., 2010), long-term relationships for information exchange and a proximate local supplier, again with smaller size for attentiveness and responsiveness, may be preferred over competitive bidding.

In the coherent action phase, we suggest that the need for a cross-functional category team is analysed, team composition is designed, and a stakeholder analysis is conducted (element 8), as the need for cross-functional approach in advance level procurement has been recognized for example in Schiele (2007), although there may be purchasing situations where procurement function dominates (low commercial uncertainty and low item complexity; van Weele, 2010), or serves as the primary owner of the category (Ellram & Tate, 2015). Next, opportunities for category performance improvement are identified by considering the set of sourcing levers (element 9; see Schiele, 2007 and Hesping & Schiele, 2015). In element 10 of the system, we identify and list category projects aimed at improving performance, drawing on the category SWOT, guiding policies, and the consideration of the sourcing levers in element 9. In element 11, the projects are prioritized with for example the simple approach suggested by O'Brien (2010) involving the consideration of ease of implementation and the potential benefits. In element 12, we suggest that the A3 report approach from Toyota is used for planning the projects (e.g. Shook, 2009), and finally, in element 13, projects are executed, measured and reported, also with the A3 formt. In planning and executing the category projects, project specific cross-functional teams may be formed, and the strategic category plan (outcome of the system) may be revised by restarting the process.

First test of the initial system

In order to demonstrate the applicability and validity of the proposed initial system we conduct a first solution-market test (Kasanen et al., 1993). The testing took place in training programme on strategic procurement management at the end of 2017 and early 2018, in two phases. First, the 13 participants of the programme (all procurement professional in their respective oragnizations, ranging from manufacturing to service provision and to utilities), spent a full day in getting familiar with the system and each of its elements. After introduction of the elements and the underlying concepts, such as the Kraljic-matrix, the participants applied the concepts in their own context, and therefore drafted a strategic category plan during the day. SWOT-analyses and matrix positions, as well as A3 reports were sketched with pens and markers on A3 size papers and discussed in smaller groups. The day ended with an assignment to develop chosen elements of the strategic category plan further, discuss and report within the organization, and prepare to discuss developments and experiences at the start of the next training next month.

Second, we design a simple online tool for allowing a "weak" solution-market test of our initial system, i.e. we sought to address the question put forth by Kasanen et al. (1993): "Has any manager responsible for the financial results of his or her business unit been willing to apply the construction in question in his or her actual decision making?" If application and adoption takes place, i.e. the construct "works", it may be inferred that the construct is valid, in addition to being linked to particular theoretical frameworks (Kasanen et al., 1993). The willingness of the participants to apply the system in their further category management work indicates usefulness or "truthfulness" of the design, comprising a "weak solution-market test" (Kasanen et al., 1993). In implementing such a test, we adapted the Juster-scale for predicting consumer purchase probability (Seymour et al., 1994) for our context, and implemented the test with the Qualtrics online survey tool. In essence, we designed a questionnaire in which each of the system elements separately (e.g. the Kraljic-matrix), as well as the entire system was displayed graphically to the respondent, and a question related to the probability of use was asked, such as the following: "On a scale from 0-10, how likely you are to use the SWOT-analysis in the diagnosis phase of category strategy planning?" Answers were prompted with a scale from 0 (Certainly would not use) to 10 (Would use certainly). Of the 13 participants in the programme, 8 submitted their responses to the questions probing the probability of use of each of the system elements. Verbal comments on the system and its usefulness were also received. As the small sample does not allow any advanced statistical analysis, we provide simple descriptive measures for the probability of use, which serves as our first solution-market test. Figure 2 presents the results of the test with the revised version of the system.

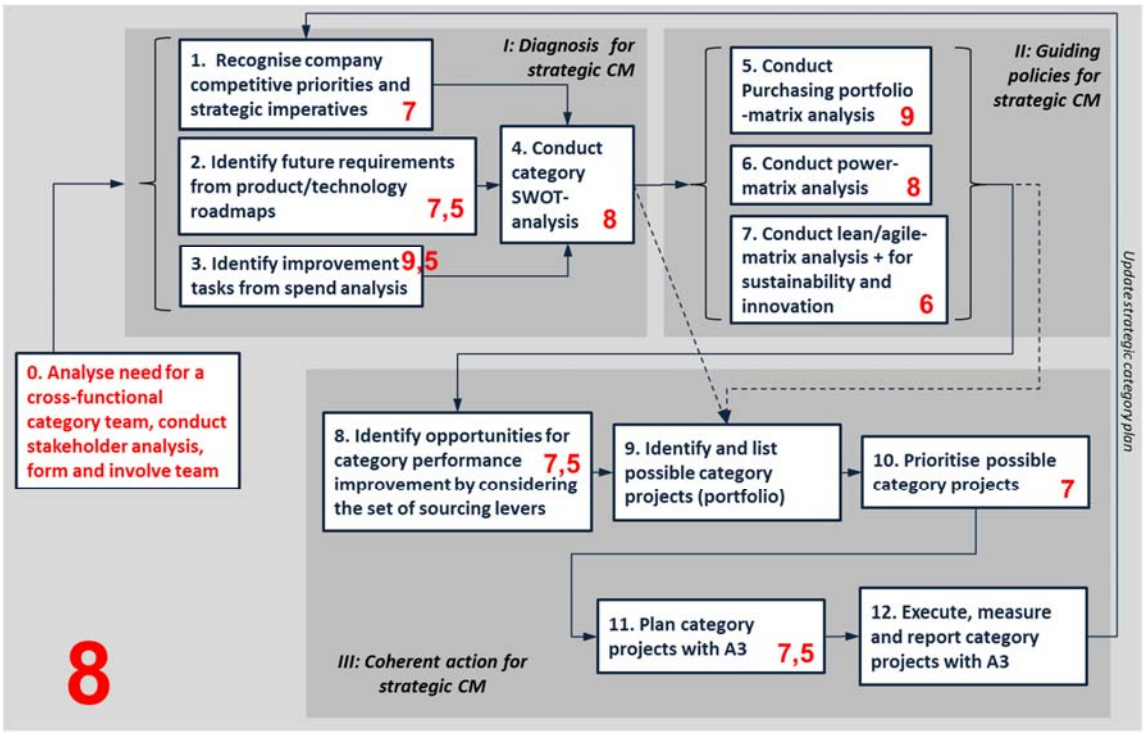

Figure 2 Revised system for strategic category management (with median values, scale 0-10; N=8)

The median values for the elements and the overall system (in the lower left-hand corner), indicate that the respondents are reasonably likely use the proposed system (median response is 8). Spend analysis and the Kraljic-matrix demonstrate strongest acceptance (median is 9.5 or 9), category-SWOT and Power-matrix are also likely to be used (median is 8), whereas the lean/agile-matrix has the lowest acceptance rate (median is 6).

The verbal comments suggested that the tools are very good, and that they allow valuable platform for evaluating existing tools. One respondent commented on the variety of the tools, and suggested that the challenge is demonstrating the value of the category approach in the organization. One respondent suggested that the process-model clarifies work and allows faster execution. This respondent also pointed out the need to have the analysis of the need for a category team more up-front, and even before the diagnosis, in order to draw appropriate competencies to the diagnosis phase, and ensure credibility and commitment of the organization. Based on this comment, the former element 8 has been moved as element 0, and now serves as a necessary enabler of the entire system and process. This revision emphasizes the cross-functional nature of the entire strategic category management process.

Conclusions and further research

The research question put forth in this paper was what should be the design of a strategic category management system? Based on literature and practitioner engagement, an initial system was designed, and then tested in training programme context. Support for the truth value of the construct, or its validity, was demonstrated by the means of a weak solution-market test, based on which the system was revised for greater emphasis on up-front cross-functional engagement.

As further research, we suggest further practitioner engagement for refining and testing the system, and efforts to demonstrate the applicability and validity of the solution through a multiple case-study with more advanced solution-market tests (Kasanen et al., 1993). One participant from the first test has already communicated willingness to apply the construct in the strategic category management of the company's indirect team. Furthermore, in order to accumulate knowledge on the association or even causality between the use of constructs for strategic category management and category or PSM performance, the framework suggested by Denyer et al. (2008) for analyzing the context, intervention, mechanism and outcome of strategic category management, could be used for conducting case studies.

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Small talk, big impact – The influence of casual collegial advice on purchasing negotiations

Jiachun Lu [a]
Lutz Kaufmann [a*]
[a] WHU – Otto Beisheim School of Management, Burgplatz 2, 56179 Vallendar, Germany, T: +49 261 650 9327 (Jiachun Lu); +49 261 650 9320 (Lutz Kaufmann), E: jiachun.lu@whu.edu; kaufmann@whu.edu

Craig R. Carter [b]
[b] W. P. Carey School of Business, Arizona State University, P.O. Box 874 706, Tempe, AZ, USA, T: +1 480 965 3679, E: craig.carter@asu.edu
[*] *Corresponding author*

ABSTRACT

The concept of behavioral supply management has attracted substantial research attention since its introduction in 2007. Nevertheless, it is still in a developmental stage, and the purchasing and supply management field represents a unique and fertile ground for more behavioral research. In this paper, we demonstrate the unchartered potential of behavioral supply management with a special focus on casual advice-giving, which is broadly present in everyday organizational interactions. The study differentiates three collegial advice types for buyers – to be honest, bluff, or lie – and investigates its influence on subsequent buyer–supplier negotiations. Scenario-based experiments show that advisees are prone to heed advice to be honest and to bluff, but not to lie in supplier negotiations. The findings are robust across both solicited and unsolicited advice and the advice-giver's job function. Finding that small talk can have a big impact, we conclude with a call for more behavioral research in PSM.

Keywords: Advice, Deception, Social learning theory, Social psychological theories, Behavioral experiments

Submission Category: Competitive Paper

INTRODUCTION

Since its beginnings, research in the purchasing and supply management (PSM) field and the broader supply chain management (SCM) discipline has been mostly grounded in the assumptions of rationality, self-interest, and utility-maximizing behavior on the part of the decision maker – a phenomenon epitomized by the sustained endeavor of scholars to integrate neoclassical economic theories and in particular transaction cost economics (Carter, Kaufmann and Michel, 2007). Numerous empirical studies, however, revealed a substantial gap between homo economicus-based theories and practices (e.g., Ribbink and Grimm, 2014; Stanczyk, Foerstl, Busse and Blome, 2015; Storey, Emberson, Godsell and Harrison, 2006). In order to make sense of this discrepancy, researchers pivot toward the tenet of *bounded rationality* where Tversky and Kahneman (1986) contend that "deviations of actual behavior from the normative

model are too widespread to be ignored, too systematic to be dismissed as random error, and too fundamental to be accommodated by relaxing the normative system" (p.52), and thus have recognized the importance of the behavioral dimension in SCM (e.g., Croson, Schultz, Siemsen and Yeo, 2013; Huo, Han, Chen and Zhao, 2015; Wieland, Handfield and Durach, 2016).

Starting with Carter et al. (2007)'s introduction of behavioral supply management as "the study of how judgment in supply management decision-making deviates from the assumptions of homo economicus" (p.634), researchers have increasingly adopted a behavioral lens in PSM studies. For instance, Moosmayer, Schuppar, and Siems (2012) reveal the power of reference prices in determining the ultimate B2B price negotiation; Hada, Grewal, and Lilien (2013) look into purchasing managers' perceived bias in supplier-selected referrals; Kull, Oke, and Dooley (2014) propose that various attributes of the purchasing situation affect cognition that in turn affects supplier selection choice; Stanczyk et al. (2015) demonstrate when and why intuition affects procedural rationality in global sourcing decision-making processes; Eckerd, Boyer, Qi, Eckerd, and Hill (2016) examine the impact of national culture on the responses of individuals to supply disruption resulting from psychological contract breach; Kaufmann and Wagner (2017) explore the potentially negative effects of affective trait diversity on sourcing team performance and how such negative effects might be mitigated through team members' emotional intelligence; and Reimann, Kosmol, and Kaufmann (2017) shed light on how cognitive, behavioral, and structural factors across the individual and organizational levels combine to bring about either dysfunctional conflict or constructive interaction in the aftermath of supplier-induced disruptions.

Whereas in the related field of behavioral *operations* management scholars draw upon both *cognitive and social psychological theories* to account for the behavioral deviations from the rationality assumption in operations (Gino and Pisano, 2008), behavioral PSM has largely relied on cognitive (e.g., with focus on biases, heuristics and personal traits) but only to a lesser extent on social psychology (e.g., with focus on national context and team traits) to better account for an array of PSM relevant phenomena.

The objective of this paper is to demonstrate that even casual collegial advice during everyday interactions can have significant impacts on the subsequent behavior of PSM professionals, an investigation which serves both as a showcase for behavioral research in PSM and at the same time as a call for more such research.

Our reasons to choose this specific research focus are threefold: *First*, in their role as boundary-spanners, procurement professionals' capabilities to interact with different stakeholders at each level of the purchasing process are assumed to be the most fundamental requirement (Tassabehji and Moorhouse, 2008). Extant studies demonstrate the relevance of communication in managing cross-functional team effectiveness and buyer–supplier relationships (Driedonks, Gevers and van Weele, 2014; Grudinschi, Sintonen and Hallikas, 2014). Nevertheless, the PSM literature has made very few inroads into addressing how procurement professionals communicate with colleagues *outside* the immediate team boundary (Driedonks et al., 2014).

Second, "small talk"— a common channel to communicate with non-close colleagues—is characterized as casual, spontaneous, and situational (Pullin, 2010; Subramanian, 2006). It can take place in various office locations—colloquially, at water coolers and copy machines in former times, and now in office kitchens and workout facilities—thus permeating organizational daily life. Small talk appears *omnipresent across all job functions*; and its potential influence is particularly relevant to those whose roles have a boundary-spanning nature, particularly procurement professionals. Further, according to Holmes and Stubbe (2003), small talk differs in terms of on-topic relevance, context-bound content, and

informativeness. Collegial advice giving is likely to occur via small talk, in the sense of a well-focused, referential talk with high information content.

Third, buyer–supplier negotiations represent one of the key means for the two parties to interact with each other (Kaufmann and Carter, 2004; Ramsay, 2004) and they have received increasing attention from PSM researchers (e.g., Thomas, Thomas, Manrodt and Rutner, 2013; Zachariassen, 2008) since the call extended by Wynstra and Knight (2004). Because buyer–supplier negotiations are also recognized as fertile *opportunities for deception* (Aquino and Becker, 2005; Tenbrunsel, 1998), companies typically draw on formal systems, such as codes of conduct (Handfield and Baumer, 2006), to mitigate the chances of ethical breaches. However, researchers argue that the efficacy of formal systems is generally nuanced and hinges also on informal systems. *Informal systems* consist of unofficial messages that convey organizational ethical norms (Smith-Crowe, Tenbrunsel, Chan-Serafin, Brief, Umphress and Joseph, 2015). Such communication also can be accessed and interpreted via (casual) conversation.

This study focuses on casual advice that comes from a non-close colleague via small talk. Based on two vignette-based experimental studies, we differentiate the advice content in terms of the perceived honesty of the advice giver, and investigate its implications for buyer–supplier negotiations. Scenario-based experiments first investigate whether the advice to engage in (dis)honest behavior toward a supplier influences a procurement professional's subsequent negotiation approach (*Study 1*). We follow the newly developed conceptualization of Kaufmann, Rottenburger, Carter, and Schlereth (2018) and make a distinction between two types of deception: a bluff and a lie. We test the effect of two situational factors on the receptiveness to the advice—namely, whether the advice has been actively solicited and what the job function of the advice-giving colleague is (*Study 1* and *Study 2*). Although the past decade has witnessed burgeoning interest in behavioral aspects of PSM by researchers, extant work pays scant attention to the influence of day-to-day activities beyond formal team settings, i.e., casual advice provided to purchasing professionals. With this paper, we aim to draw attention to the underexplored potential of the behavioral PSM by providing first insights into how receiving advice in a seemingly casual context overshadows purchasing professionals' subsequent interactions with suppliers in a negotiation. The observed effects in such a "light touch" setting indicate that there remains a dearth of behavioral research opportunities in PSM in general.

The remainder of the paper is organized as follows. In the next section, we discuss the relevant literatures and develop hypotheses on this basis. We then describe two vignette-based experimental studies and present our findings. Afterwards, we discuss the theoretical and managerial implications as well as limitations pertinent to our research. To conclude, we "zoom out" and consider the broader opportunities for behavioral PSM research, with *casual advice* as an example.

THEORIES AND HYPOTHESES

Small Talk and Social Learning Theory

Small talk is ingrained in organizational daily life. Taking the role of boundary-spanner, PSM professionals not only have to intentionally manage the communication process and content (Driedonks et al., 2014; Large, 2005), but also gain access to various types of information communicated during informal communications. As a form of informal communication (Pullin, 2010), small talk is spontaneous and situational (Subramanian, 2006) and usually starts with icebreakers such as greetings, general observations, and questions (Yang, 2012).

Anthropologists (Malinowski, 1946) define small talk as "phatic communion," which serves purely to establish a social bond and does not represent purposeful communication. However, this restrictive view—that the meaning behind small talk lies only in the speech act itself, and not in the content—has been contested by sociolinguists. Coupland (2000, 2003) argues that small talk is not necessarily devoid of information, but that it represents an intrinsic part of the talk. Holmes and Stubbe (2003) point to the dynamic nature of workplace small talk and conceptualize it in terms of a continuum, ranging from phatic communication on one end of the continuum, through social talk, and work-related talk, to core business talk on the other end; the continuum represents a stepwise increase in on-topic relevance, context-bound content, and informativeness. In this perspective, advice-giving and advice-taking are likely to occur via small talk, as a well-focused, referential talk with high information content.

Social learning theory posits that individuals generally do not possess innate repertoires of behavior, but rather acquire them over time (Bandura, 1977). Whereas this learning process typically consists of observing, imitating, and modeling the behavior of others (Bandura, 1977), researchers find that organizational ethical conduct can be learned in part through conversations with peers (Smith-Crowe et al., 2015). That is to say, actions of others being observed do not constitute a sine qua non for the social learning process, it can take place in social conversations. Therefore, we argue that procurement professionals are likely to acquire information embedded in casual collegial advice conveyed through small talk and this information in turn can have a bearing on their subsequent behaviors, such as negotiations with suppliers.

Advice and Buyer–Supplier Negotiations

In organizational studies, advice has been investigated as a special form of *social support* (e.g., Chentsova-Dutton and Vaughn, 2012; Deelstra, Peeters, Schaufeli, Stroebe, W., Zijlstra, F. R. and van Doornen, 2003; Feng and Magen, 2016) and *help* (e.g., Brooks, Gino and Schweitzer, 2015; Erdogan, Bauer and Walter, 2015). In this research, we follow the approach by Chentsova-Dutton and Vaughn (2012), and define advice as suggestions or directives intended to shape others' ways of thinking, feeling, or behaving.

In buyer–supplier negotiations, various factors, such as pricing, delivery terms, shipment schedules, and quality standards, are at stake (Thomas et al., 2013); hence, technical experts often are present both during the preparation and at the negotiation table to provide procurement professionals (i.e., negotiators) with advice upon request. However, whether collegial advice offered via small talk before the negotiation influences the buyer's negotiation approach remains unexplored. An empirical inquiry seems warranted in light of the ubiquitous nature and potential referential function of small talk in the workplace, and in light of the uncontestable importance of buyer–supplier negotiations for both the PSM field (Wynstra and Knight, 2004) and general organizational strategic benefits (Faes, Swinnen and Snellinx, 2010). Further, because extant studies have repeatedly demonstrated that boundary-spanners are often confronted with opportunities and incentives to intentionally mislead other parties (Bhattacharya, Singh and Nan, 2015; DeYong and Pun, 2015; Hawkins, 2013; Wang, Zhang, Wang and Sheng, 2016), we are particularly interested in the influence of collegial advice on buyer–supplier negotiations from the perspective of honesty. Moreover, we follow Kaufmann et al. (2018) and make a distinction between two types of active deception: bluffs and lies. Adopting a convention-dependent and norms-based perspective, they define a bluff as a deception which is palatable to both parties (and as such amoral) in a buyer–supplier negotiation and a lie as a deception which is not deemed acceptable to either of the parties (and as such immoral).

Peers are found to have a significant effect on (ethical) decision-making (Craft, 2013; Lehnert, Park and Singh, 2015; Westerman, Beekun, Stedham and Yamamura, 2007). Although social

learning theory lends strong theoretical support for this contention (O'Fallon and Butterfield, 2005) and as previously argued, behaviors could be acquired through both observations and conversations, it should be noticed that *advised* behaviors are not perceived, valued, and followed (i.e. *learned*) in the same way as *observed* behaviors because advisees are prone to ego-centrically discount advices (Bonaccio and Dalal, 2006; Yaniv and Kleinberger, 2000).

Ego-centric discounting is the most robust empirical finding in the advice-taking literature. Researchers have explored a plethora of factors to explain why advice receivers discount the advice they're given. Social psychology indicates that help in any form restricts the perceived behavioral freedom, which in turn leads to a negative psychological state called reactance (Brehm, 1966); more generally, the perceived restriction poses a threat to self-esteem and decision autonomy (Dalal and Bonaccio, 2010). In addition, although advice recipients have full access to internal justifications for arriving at a particular decision, they do not have access to an advice giver's reasoning and supporting evidence (Bonaccio and Dalal, 2006; Tzioti, Wierenga and van Osselaer, 2014). Advice discounting could also occur as a result of various cognitive biases, such as overconfidence, perseverance, or a confirmation bias (Yaniv and Kleinberger, 2000). Furthermore, predicting the motives of the advice giver is not possible (Sniezek and van Swol, 2001; Tzioti et al., 2014), and even well-intended advisors frequently recommend that others act differently than they would act themselves (Dana and Cain, 2015).

While extant empirical studies predominantly focus on advice about a *judgment task* which involves estimates or forecasts of a quantitative nature (Reyt, Wiesenfeld and Trope, 2016) (e.g., Gino and Schweitzer, 2008; Hooge, Verlegh and Tzioti, 2014; See, Morrison, Rothman and Soll, 2011), advice on a *choice task* with qualitatively different alternatives (Bonaccio and Dalal, 2006; Sniezek and Buckley, 1995) has received significantly less attention. More specifically, to the best of our knowledge, there has been no research dedicated to examine acceptance of the advice on a choice task, which not only includes qualitatively different alternatives but alternatives that are judged differently through an ethical lens (e.g., to be honest, to bluff or to lie). We therefore tentatively posit the following hypothesis:

> ***H1****: Collegial advice conveyed via small talk influences the advice recipient's behavior in a subsequent buyer–supplier negotiation.*

Solicited vs. Unsolicited Advice

In the relatively scant research on the reception and rejection of unsolicited advice, the consensus is that unsolicited advice is more often discounted than explicitly requested advice; unsolicited advice can be considered intrusive, inappropriate, and condescending, and it raises greater autonomy and self-esteem concerns (Fitzsimons and Lehmann, 2004; Goldsmith, 2000; Goldsmith and Fitch, 1997; Hinojosa, Gardner, Walker, Cogliser and Gullifor, 2017; Reinhardt, Boerner and Horowitz, 2006). Furthermore, although relational closeness typically is characterized by a high level of trust (Feng and Magen, 2016), which in turn represents an important precursor to advice-taking (Dalal and Bonaccio, 2010; Sniezek and van Swol, 2001), Feng and Magen (2016) caution that unsolicited advice even from a close friend still can engender negative reactions. We expect that this differential receptiveness to solicited and unsolicited advice also occurs in the context of advice offered by a colleague via small talk in relation to a subsequent buyer–supplier negotiation. Therefore, we hypothesize that:

> ***H2****: When given advice about a subsequent buyer–supplier negotiation in the context of small talk, the recipient is more likely to follow the advice if it has been actively solicited than if it is unsolicited.*

Departmental Thought Worlds

Differences in departmental thought worlds have received sustained attention from scholars of various disciplines, such as marketing (Homburg and Jensen, 2007), strategy (Frankwick, Ward, Hutt and Reingen, 1994), and operations and supply chain management (Niranjan, Rao, Sengupta and Wagner, 2014). Organizational roles lead to different thought worlds (Dougherty, 1992) with different perceptions and situated representations of the task environment (Boland and Tenkasi, 1995; Niranjan et al., 2014). Whereas studies repeatedly suggest a positive relation between (functional) diversity and idea generation (e.g., Dayan, Ozer and Almazrouei, 2017; Jehn, Northcraft and Neale, 1999), intergroup bias resulting from social categorization remains a stumbling block to fully reap the benefits of diversified workplaces (van Knippenberg, Dreu and Homan, 2004). Different thought worlds might impede knowledge transfer and integration in cross-functional teams (Kellogg, Orlikowski and Yates, 2006; Majchrzak, More and Faraj, 2012). Hence, we argue that people are less receptive to advice provided by a colleague from another function (i.e., one embedded in a different thought world). This response should hold particularly for PSM professionals, who frequently encounter colleagues with different functional backgrounds, including sales and R&D. Therefore, we hypothesize that:

> ***H3****: The job function of the advice-giving colleague moderates the advice recipient's receptiveness to the advice.*

The inter-relationships among the hypotheses are displayed in Figure 1.

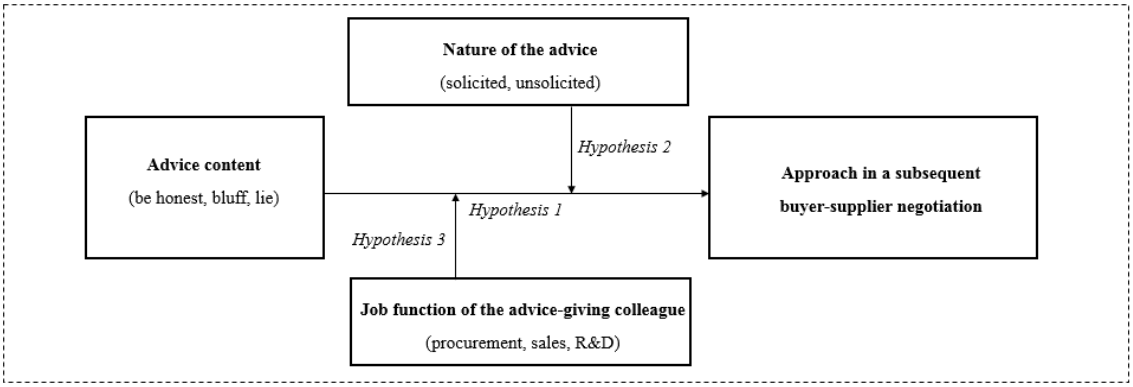

Figure 1: Research model

METHODOLOGY

We conducted two vignette-based experimental studies (Bachrach and Bendoly, 2011; Eckerd, 2016; Rungtusanatham, Wallin and Eckerd, 2011) to assess our hypotheses. The vignette methodology is well-suited for our research purpose for four reasons. First, vignettes allow researchers to examine sensitive topics where individuals are usually reluctant to share information (Pilling, Crosby and Jackson, 1994), such as indicating whether they will engage in (dis)honest behavior in the subsequent encounter with suppliers. Second, vignette experiments help generate more valid and reliable data by standardizing the social stimulus across respondents (Alexander and Becker, 1978). Third, vignette design has proven conducive to understanding how and why individuals make decisions in the SCM discipline (Tangpong, Hung and Ro, 2010; Thomas, Davis-Sramek, Esper and Murfield, 2014). Fourth, researchers have adopted vignette experiments to investigate buyer-supplier negotiations (Kaufmann et al., 2018; Thomas et al., 2013). In addition, to avert carryover effects on the part of the participants, both studies used a between-subjects design.

Study 1

This study used a 3 x 2 design (*advice content*: be honest, bluff, lie; *nature of the advice*: solicited, unsolicited), plus two control conditions.

Vignette design. Participants assumed the role of a buyer who would soon enter into the last round of a negotiation for marketing services to be provided by an agency. The only remaining objective in the last round of negotiations was to convince the supplier to reduce the price from the previous offer. Before entering the negotiation, participants met a colleague who was a manager for an unrelated spend category in the procurement department.

Depending on the assigned treatment group, each participant received one piece of advice from the colleague about how to convince the supplier to reduce the price, drawn from the 3 (i.e., be honest, lie, bluff) by 2 (i.e., solicited, unsolicited) study design. In addition, we included two control groups: In *control condition A*, participants actively sought advice but were told to make their own decision; in *control condition B*, no colleague was present. Participants then answered the survey question about the approach they planned to take in the final negotiation round. They had three options: being honest, bluffing (false threat), and lying (false promise), according to the taxonomy of Kaufmann et al. (2018).

Because participants' correct understanding of the situation was crucial for them to accurately interpret whether each of the three options represents an honest approach, we purposefully designed instruction questions to identify and exclude participants who chose to bluff or to lie without knowing that their chosen approach was to be dishonest.

Vignette validation. We closely followed the steps outlined by Bachrach and Bendoly (2011), Rungtusanatham et al. (2011), and Walker (2014) to ensure that our vignette was realistic, believable, interesting, and effective. In order to increase the external validity of our research, we chose people with at least two years of work experience in either a sales or supply management position as our unit of analysis for both the pilot test and the final data collection. During the design stage, we pre-tested an initial version of our vignette with n=340 participants from two business schools (M_{age}=21.9 years) and incorporated their feedback to refine our design. In the post-design stage, we conducted two pilot tests with practitioners. The first pilot test included a sample of n=246 professionals ($M_{work\ exp}$=17.2 years; $M_{negotiations}$=31 B2B negotiations), and the second included n=122 professionals ($M_{work\ exp}$=16.4 years; $M_{negotiations}$=22 B2B negotiations). Based on the feedback obtained from the pilot tests, we made final adjustments to our vignette.

Sample. The initial sample consisted of n=447 North American purchasing and sales professionals, recruited using a U.S.-based survey research firm. The data were collected in one survey period. Of the 447, 14 participants were excluded for failing to answer the instruction checks correctly. Another 18 participants were excluded because they finished the exercise in less than five minutes or more than one hour, which we interpreted on the basis of our pilot tests as either a lack of careful reading and considered decision-making or as getting distracted during the exercise, respectively. The remaining 415 participants (90.6% usable rate; 191 male; M_{age}=38.0 years; $M_{work\ exp}$=17.6 years, $M_{negotiations}$=74 B2B negotiations) were randomly allocated to eight conditions.

Results. Participants were asked whether they found the scenario realistic and were able to imagine themselves in the situation (Dabholkar, 1994). With M= 5.98 on a seven-point Likert-type scale, the realism check indicates that perceptions of the scenario were adequate to induce authentic responses (Reimann, Shen and Kaufmann, 2017; Thomas et al., 2014; Thomas et al., 2013).

We conducted a univariate analysis of variance (ANOVA) on the aggregated perceived honesty measure (α=0.97), which revealed a significant effect of condition on the perceived honesty of the advice ($F(2,301)=602.44$, $p<.001$). A planned difference contrast demonstrated that advice to lie (M=1.85, SD=0.81) was perceived as significantly less honest than both advice to bluff (M=2.54, SD=1.22) and advice to be truthful (M=6.26, SD=0.81) ($t(220)=-2.547$, $p<.001$), and that advice to bluff was perceived as significantly less honest than advice to be truthful ($p<.001$) ($t(220)=-3.73$, $p<.001$). Taken together, these results indicate that the manipulations for *advice content* were successful. In addition, participants could only proceed if, depending on the assigned condition, they correctly answered whether the advice had been actively solicited or not, ensuring a successful manipulation for *nature of the advice*.

For *hypothesis 1*, we explore whether casual advice influences the advice recipient's subsequent negotiation approach. A cross tabulation analysis revealed a statistically significant association ($\chi^2(8)=98.01$, $p<.001$, *Cramer's V*=0.344). However, a pairwise χ^2 association analysis demonstrated that no non-random difference occurred – neither between the *lie* and *control condition A* ($\chi^2(2)=4.63$, $p=.10$), nor between *lie* and *control condition B* ($\chi^2(2)=0.70$, $p=.70$), nor between two control conditions ($\chi^2(2)=1.79$, $p=.51$). Taken together, the findings showed that advice to be honest and to bluff is related to the participants' subsequent negotiation approach, but advice to lie was fully discounted.

Because we found no pairwise difference between *lie, control condition A*, and *control condition B* in terms of the subsequent negotiation approach, and because the best way to assess the influence of advice is to juxtapose it with a decision-making context devoid of advice, we then limited our focus to *honest*, *bluff*, and *control condition B* (i.e., no presence of a colleague) and conducted a multinomial logistic regression, with the *advice content* (i.e., be honest, bluff, and no presence of a colleague) as the predictor, and the subsequent negotiation approach (i.e., be honest, bluff, lie) as the dependent variable to be predicted. The results indicate that the *advice content* significantly predicted whether the advice recipient chose to behave honestly, to bluff, or to lie ($\chi^2(4)=86.155$, $p<.001$). In addition, in comparison with those who had no interaction with a colleague and made their own decision, those who had been advised to behave honestly were 3.32 times more likely (p=.013) to behave honestly than to bluff. Meanwhile, those who had been advised to bluff were 7.12 times more likely (p<.001) to bluff than to behave honestly but also were 7.03 times more likely (p<.001) to bluff than to lie. Thus, our findings provide *partial support* for *hypothesis 1*.

For *hypothesis 2*, we investigate whether the receptiveness to advice is determined by whether the advice had been solicited or not. We computed a dummy variable, "Match/No match," to measure the outcome of *receptiveness to advice*, following Sniezek and Buckley (1995). "Match" indicated the cases in which participants in the *honest condition* chose to behave honestly, participants in the *bluff condition* chose to bluff, and participants in the *lie condition* chose to lie. All other cases represented a "No match." The dummy variable, "solicited/unsolicited," is the predictor. Furthermore, factors identified in the literature as predictors for advice-taking – i.e., *task difficulty*, *perceived advice quality*, *self-confidence*, *dependent decision-making style*, and *decision-making anxiety* (Dalal and Bonaccio, 2010; Gino, Brooks and Schweitzer, 2012; Gino and Moore, 2007; Tost, Gino and Larrick, 2012) – were controlled for in the analysis. The scales were either self-developed or adapted from previous studies, and all scales achieved a reliability score greater than .80. We also controlled for the influence of participants' age and gender. Because the hypothesized differential effect of solicited and unsolicited advice can only be convincingly measured and interpreted when the advice is the same, we conducted three independent binary logistic regression tests based on the *advice content* (i.e., *honest condition*, *bluff condition*, and *lie condition*). The results showed that regardless of the advice content, the advice-taking behavior was not affected by whether or not the advice had been solicited (*honest condition*, p=.16; *bluff condition*, p=.60; *lie condition*, p=.07). Thus, *hypothesis 2* is *rejected*.

Study 2

In the second experiment, we shifted the focus from the *nature of the advice* to the *characteristics of the advice-giving colleague* and deployed a 3 x 3 design (*advice content*: be honest, lie, bluff; job *function of the advice-giving colleague*: procurement, sales representative, development engineer), with one control condition of *no presence of a colleague*.

Vignette design. The scenario description strongly resembled the first experiment. Participants assumed the role of a buyer who would soon enter into the last round of negotiations over a special tone wood for a musical instrument producer. The only remaining objective was to convince the wood supplier to reduce the price. Before entering the negotiation, participants met one colleague who offered a piece of advice. Participants then answered the survey question about the approach they would take in the final negotiation round. The options were identical to those in the first experiment, with a minor adaptation to the spend context. Participants in the nine treatment conditions also were asked to indicate their overall perception of the advice-giving colleague. Participants in the treatment conditions were then informed that they would work with the advice-giving colleague in a cross-functional sourcing team, and were asked to indicate their relational expectations for this colleague and for the cross-functional team.

Sample. The initial sample consisted of n = 510 North American purchasing and sales professionals, recruited using a U.S.-based survey research firm. Participants had to have at least two years of work experience in either a sales or supply management position. The data were collected in one survey period. Of the 510 participants in the initial sample, 32 were excluded for failing to answer the instruction checks correctly. Another two participants were excluded because they completed the survey within five minutes, which we assumed to be indicative of non-attentiveness, given the length of the survey. The remaining 476 participants (93.3% usable rate; 182 male; M_{age} = 38.0 years; $M_{work\ exp}$=18.6 years, $M_{negotiations}$=84 B2B negotiations) were randomly allocated to the 10 conditions.

Results. Participants indicated that they perceived the scenario as realistic (M=6.04). Similar to the first experiment, both the ANOVA test and a planned difference contrast showed that the manipulations for *advice content* had been successful. In addition, participants could only

proceed if, depending on the assigned condition, they correctly identified the *job function of the advice-giving colleague*, ensuring its successful manipulation.

The test of *hypothesis 3* was very similar to that of *hypothesis 2*. We first computed a dummy variable, "Match/No match," to measure the outcome, *receptiveness to advice* (Sniezek and Buckley, 1995). *Job function of the advice-giving colleague* served as the predictor, and as in the first experiment, we controlled for *task difficulty*, *perceived advice quality*, *self-confidence*, *dependent decision-making style*, *decision-making anxiety*, and participants' age and gender. All scales achieved a reliability score of greater than .80. We then conducted three independent binary logistic tests on the basis of *advice content* (i.e., *honest condition*, *bluff condition*, and *lie condition*). Results showed that regardless of the advice content, the job function of the advice-giving colleague did not affect the advice-taking behavior (*honest condition*, p=.95; *bluff condition*, p=.50; *lie condition*, p=.41), causing the *rejection* of *hypothesis 3*.

DISCUSSION AND MANAGERIAL IMPLICATIONS

Taking the role of boundary-spanners, procurement professionals deal with internal and external suppliers and organizational customers on a daily basis. Consequently, a structural hole (Burt, 2009) often appears between buying organizations and their suppliers, giving procurement professionals ample opportunity to play one party off against the other for their own benefit. Companies conventionally resort to formal control systems, such as compliance programs and codes of conduct, to curb dishonest conduct. Nevertheless, researchers cast doubt on the effectiveness of formal systems and advocate for informal systems as another component of the organizational ethical infrastructure. The norms espoused by informal systems might or might not be ethical (Smith-Crowe et al., 2015). Tenbrunsel and Messick (2004) note the danger of mixed signals from formal and informal systems, arguing that uncertainty breeds opportunistic actions. From this perspective, casual advice involving ethical issues represents one manifestation of informal systems. One objective of this showcase is to bring casual advice to the forefront by examining its influence on purchasing professionals' subsequent negotiations with suppliers.

We differentiated the advice content in terms of advice to be honest, advice to bluff, and advice to lie. In general, our results showed that a piece of collegial advice via small talk influenced the advice recipient's behavior in subsequent buyer–supplier negotiations. However, a closer inspection revealed a differential effect of the advice. Compared with those who had not engaged in any advice giving or taking but had made their own decision, advice recipients who had been advised to be honest were 3.3 times more likely to behave honestly than to bluff. Those who had been advised to bluff were 7.1 times more likely to bluff than to behave honestly, but also were 7 times more likely to bluff than to lie. In addition, advice to lie was fully discounted, and participants made their decision as if they had received no advice.

We contribute to the theoretical advancement of the use of deception in buyer–supplier negotiations, highlighting the effect of a situational variable—casual advice—which permeates organizational daily life but has so far slipped under the radar of researchers. Further, we contribute by offering the first indication, to the best of our knowledge, that business bluffing needs to be further reconceptualized. Kaufmann et al. (2018) consider lying and bluffing to be two distinct constructs, and they attribute the main difference to the consequences for their targets. They argue that the targets of lies perceive the actor as being *im*moral and are unwilling to negotiate with the actor again, while the targets of bluffs perceive the actor as being *a*moral and *are* willing to negotiate again in the future. Our findings suggest that the difference between bluffing and lying might also be reflected in the advice recipient's different acceptance of bluffing advice and lying advice.

We suggest that managers pay more attention to their organizations' informal control systems. Although actively shaping these systems takes effort, our results reveal that even small talk with a non-close colleague during lunch time could influence procurement professionals' preferred approach in negotiating with suppliers. Working in a compliance culture, exemplified by an environment where honest actions are both modeled and advocated via informal communication systems, can indeed motivate procurement professionals to follow suit. Moreover, the influence of advice to bluff seems to be unclear: while the advice can move buyers away from truth-telling behavior (being honest), it also might prevent buyers from engaging in unethical behavior (lying). However, our results demonstrate that buyers seem unwilling to follow advice that advocates lying. One possible explanation is that they can't predict all the motives of the advice giver (Sniezek and van Swol, 2001; Tzioti et al., 2014) and are unsure of the benevolence of this advice. This uncertainty becomes more salient when the advice-giving colleague suggests lying, leading the recipient to fully discount the advice.

Our results also demonstrate that, regardless of the advice content, recipients treat B2B negotiation-related solicited advice and unsolicited advice equally. This finding illustrates a boundary condition (Busse, Kach and Wagner, 2016) of the extant advice literature, which posits that unsolicited advice is discounted to a greater extent than advice that is explicitly asked for (e.g., Fitzsimons and Lehmann, 2004; Reinhardt et al., 2006). One potential explanation is that advisees are rather indifferent to whether the advice is solicited or not because organizations increasingly embrace an open communication culture and hail it as a boost to organizational performance.

In addition, we found that another situational variable—the job function of the advice giver—does not influence receptiveness to the advice. Procurement professionals likely see the advice from sales colleagues as equally credible to advice received from procurement professionals, probably because sales colleagues are experienced negotiators (i.e., they know "how"); and similarly, advice from R&D colleagues also has credibility probably because these colleagues are familiar with the product (they know "what").

For managers, the robustness of the results showing how these two critical situational variables influence the effects of advice on subsequent negotiations further underscores the need to monitor advice-giving in casual contexts. The maturity of the compliance culture surrounding a PSM function does seem to affect supplier negotiations.

LIMITATIONS AND FUTURE RESEARCH

In our studies, we operationalized advice acceptance as "matching" in terms of consistency between an advice recipient's decision and the advice giver's recommendation (Sniezek and van Swol, 2001). Researchers contend that this method of measurement is misleading because it does not consider the advice recipient's pre-advice choice; the argument is that advice-taking occurs or "counts" only when it causes the advice recipient to *switch* from his or her pre-advice choice to the alternative recommended by the advice-giving colleague (Bonaccio and Dalal, 2006). We admit that first asking for participants' pre-advice choice and then providing them with the advice could yield further insights. However, we examined various treatment conditions on a group level and compared their choice patterns with that of the control condition, in which a choice was made without the influence of advice. Therefore, the decisions reached by those in the control condition provide similar data to that of the pre-advice choice and might convincingly serve as a basis for comparison.

We limited our focus on participants from North America and did not consider those with other cultural backgrounds. While the macro-level national culture represents a significant variable

influencing an individual's intention to behave ethically, researchers consistently demonstrate that the *micro-level peer influence* exerts a greater effect (Westerman et al., 2007). Therefore, we argue that casually given collegial advice may also influence one's negotiation approach in a different culture. Yet, it would be interesting to find how such qualitatively different advices (i.e. to be honest, to bluff, or to lie) will be perceived and to what extent they will be followed, because certain cultures attach more importance to humility (Taras, Kirkman and Steel, 2010), which might reduce ego-centric discounting and impact advice-taking behavior (Kausel, Culbertson, Leiva, Slaughter and Jackson, 2015). By the same token, industry and organizational culture overshadow individual decision-making but are unlikely to override the influence of proximal social referents (i.e. reactions to collegial advice) – although this is another potential area for future research.

With our findings providing evidence that collegial advice offered in a casual manner takes its toll on buyers' subsequent negotiation approach, we strive to shed light on the under-tapped potential of behavioral PSM research. As a complementarity to the already largely adopted cognitive psychological lens, we would like to specifically draw attention to the *social psychological perspective*. Entrusted with various strategically important tasks, such as mitigating supply risks, improving cost savings, ameliorating product quality and processes, and boosting innovative capabilities (Azadegan and Dooley, 2010; Azadegan, Patel, Zangoueinezhad and Linderman, 2013; Day and Lichtenstein, 2006; Feisel, Hartmann and Giunipero, 2011; González-Benito, 2007; Zsidisin and Ellram, 2003), PSM professionals interact with internal organizational customers and external suppliers on a daily basis. These frequent interactions with different stakeholders provide ample opportunities for research with a social psychological approach.

Using our empirical studies as an example, we adopt the "5W and H" approach (Cao and Lumineau, 2015) and highlight in Table 1 how a specific behavioral focus (i.e. casual advice) might be incorporated in both *intra*- and *inter*-organizational PSM research and thus help advance our understanding of various PSM activities. For instance, while our studies focus on advice-recipients, future studies may focus on advice *givers* as the unit of analysis by investigating their emotional and behavioral reactions to the advice recipient if their advice is not followed. Building on our empirical setting, the effect of casual advice-giving may go beyond the advice-related buyer-supplier negotiation. Since in social interactions, people engage in information processing to form and update impressions (Asch, 1946; McArthur and Baron, 1983), previous advice-encounters in casual contexts may well set the initial tone for how the procurement professional interacts with the advice-giving colleague in a *future collaboration*, and the same applies to the advice-giving colleague. Empirical studies in this arena are much needed, because many organizations employ cross-functional teams for critical PSM tasks (Driedonks, Gevers and van Weele, 2010; Kaufmann, Meschnig and Reimann, 2014). A dyadic perspective, taking into consideration both advisor and advisee, including various dispositional variables (e.g., personality traits and role identity) pertaining to them, may shed additional insights into the dynamic advice-giving and -taking process as well as its implications.

Further, researchers could look beyond the boundary of the organization. Procurement professionals often represent the most important, if not the only, touch-point for suppliers. Because companies increasingly rely on external sources to advance knowledge and innovation (van Echtelt, Wynstra, van Weele and Duysters, 2008), future research might examine how and when procurement professionals transfer, e.g., a supplier's advice into the buying organization. In particular, there would be value in exploring how cognitive (e.g., rational or emotional information processing), structural (e.g., power distribution between buying company and

supplier) and situational (e.g., advice-content related) variables combine in complex ways to facilitate or inhibit this advice transfer. Beyond that, questions of how advice passes from lower-tier suppliers to the buying organization are of particular relevance, because they may help better account for critical PSM activities such as supply risk mitigation. This line of inquiry invites studies adopting a supply chain view (Carter, Kosmol and Kaufmann, 2017; Carter, Rogers and Choi, 2015).

Having provided an empirical investigation of the effect of casual advice on buyer-supplier negotiations, and expanded upon how researchers may incorporate this specific behavioral focus in future studies, our hope is that this paper highlights the still underexplored potential of behavioral research in PSM and helps guide future work in this field.

Table 1: Exemplary Research Agenda

	What? **Area to investigate**	**Who?** **Dispositional Variables**	**Where?** **Contextual Variables**	**When?** **Temporal Variables**	**Why?** **Relevance**	**How?** **Managerial Interventions**
Key concepts	**Topic area:** Advice-recipients' perception of the advice-giver and its implications Advice-givers' reactions to the advice-recipient's behavior and its implications Process of advice-transferring **Advice-related factors:** qualitative vs. quantitative nature, solicited vs. unsolicited	**Individual-level:** role identity, personality traits, cultural background **Team-level:** team composition, role assignment	Power asymmetry, industry dynamics	Time criticality of the advice-related decision-making, transferring the advice (soon or late), history between the advice-recipient and -giver	What could casual advice-giving bring about in the PSM field?	Measures to make use of the omnipresent causal advice-giving/taking activities
Possible research questions	• Does previous advice-related encounter impact the advice-receiving buyer's perception of the advice-giving colleague? And in which contexts will these perceptions play out? (e.g. cross-functional collaboration, sustainable SCM initiatives) • What could be the social rewards and	• How do personality traits influence boundary spanners' intention to accept, reject or transfer the advice? • How do different functional level "thought worlds" reveal themselves in the advice-giving/taking process? • Does certain cultural	• To what extent does the power asymmetry between the boundary spanners (i.e. buyer vs. supplier) impact the advice-giving/taking process? • Do highly dynamic industries profit as a whole from frequent inter-organizational advice-giving activities?	• Are advice-recipients more willing to heed the advice when the related decision-making is imminent? • What factors influence buyers' speed to transfer suppliers' advice into the buying organization?	• What types of and how do casual advices pass from lower-tier suppliers to the buying organization and backwards? • What could be the facilitating and inhibiting factors in the above process?	• Which archetypes of advice do buyers receive from colleagues in casual context? Do they complement or undermine the formal communication and control system? • How can buying organizations structure incentive systems to encourage suppliers to

	What? Area to investigate	Who? Dispositional Variables	Where? Contextual Variables	When? Temporal Variables	Why? Relevance	How? Managerial Interventions
	costs for the advice-giver? • Do advice-giving colleagues/suppliers punish the buyers if their advices are not followed? And how (refrain from offering advice in the future or execute more severe ones)? • When do buyers transfer a supplier's advice to the buying organization?	background (e.g. value social harmony vs. value self-enhancement) make the advice-recipient more or less likely to heed the advice? • Does a team react more open (e.g. due to reduced ego-centric discounting) or reluctant (e.g. due to "not invented here syndrome") to advice from outsiders? Does the level of diversity play a role here?				actively provide advices?
Promising theories	Social learning theory, social perception paradigm, social network theory	Social identity theory, role identity approach, institutional theory, work-group diversity	Complex adaptive system, theory of reasoned action	Temporal orientation, deferential association theory	Information processing view, supply chain practice view	Ethical infrastructure, organizational commitment, supply chain practice view

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Digital purchasing tools in supply chain

Tommi Mahlamäki,[1] Mika Ojala[2]

[1] Department of Industrial Management, Tampere University of Technology,
P.O. Box 541, FIN-33101 Tampere, Finland
p. +358 500 866 641
tommi.mahlamaki@tut.fi

[2] p. +358 50 525 6205
mika.k.ojala@gmail.com

Abstract

Digital tools are shaping today's sales and purchasing. The majority of the current tools are used within a single company, but some tools and solutions can be used collaboratively across the company borders. The goal of this research is to analyze these collaborative situations to identify both the drivers and the challenges of building digital purchasing tools. By conducting a multiple-case study of industrial manufacturers and their distributor partners, we have received rich data that gives insight into this topical issue. The main contribution of the research is a model that distinguishes the drivers and challenges of the collaborative tools.

Keywords: Purchasing tools, digitalization, sellers, distributors

Working paper

1 INTRODUCTION

Sales and purchasing are among the critical functions in a firm. Digital tools and digital information are transforming sales, not least because the buyers use new tools in their role. The nature of organizational buying in business-to-business setting is shaping also the nature of selling (Ulkuniemi, Araujo and Tähtinen, 2015). The role of human interaction in sales cannot be underestimated but, it is not the only way how companies can give information and convince customers about the company's offering. People use frequently different digital tools in searching and comparing different products and services.

The sales/purchasing interface is facing many changes in the industrial companies. The globalized arena of buying and selling is one of the reasons for more complex settings in the relationships. In the fierce competition and development of new IT solutions, it is evident that many business practices and processes are changing and the dynamics between the companies in the distribution channel face some challenges. Sales especially at B2B context is an area where the traditional view of face-to-face salesmen has been challenged during the last decade. The sales force automation (SFA) and configure-price-quote (CPQ) -systems are examples of this change in selling.

One of the critical customer development tasks is the development of SFA tools targeted to buyers. For that reason the benefits of SFA tools is an important research topic. Even though that many of the SFA tools are used collaboratively by sellers and buyers, majority of the research regarding SFA benefits focuses on mainly the selling company (Holloway, Deitz, and Hansen, 2013; Bush, Moore, and Rocco, 2005; Barker et al., 2009) and in limited way to the customer (Boujena, Johnston and Merunka, 2009). This research tries to address this research gap by examining the benefits and challenges of SFA use in situations where the tools are used collaboratively by both seller and buyer.

Sales configurators are a SFA tool that can be used in the sales process in providing product information on different product options and feasible configurations. Sales configurators can be used to also to provide pricing and availability information. Developing sales configurators requires deep understanding of the customer requirements and preferences and can be categorized as a customer development activity.

In this paper we address the following two main research questions. 1) What are the benefits of sales configurators in collaborative use between buyer and seller 2) What are the challenges of sales configurator use in collaborative use .While we are mainly interested in the usage of sales configurators in collaborative setting, we are not limiting the inquiry to those situations. In order to gain deeper knowledge of the benefits and challenges we extend the research focus to situation where the tools are used internally in the seller or buyer company. We hope that this gives us additional information to analyze the phenomena more comprehensively.

To address the research questions, we develop a two-wave qualitative research design. All together 41 dyadic in-depth interviews were conducted. The first wave of interviews were conducted in selling companies and consecutively the second wave in buyer companies. Datasets of 25 seller side and 16 buyer side interviews were analyzed to answer the research questions.

The main contribution of this study is the identification of both benefits and challenges of collaborative sales force automation tool use. We also make a distinction of the benefits and challenges in six different context. For both seller and buyer three situations: internally, pre-relationship and during the relationship. The study contributes to the SFA literature by adding to the results of Holloway et al., 2013 and Boujena, et al., 2009.

2 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Understanding how current sales in a B2B context are changing because of digital tools requires exploration of two theoretical aspects: digitalization of sales and seller-distributor relationships, which are discussed next.

2.1 Digitalization of Sales and purchasing processes

Sales is one of the areas that is changing due to new digital tools. Most of the articles in this field look at the adoption of sales technology within one company (e.g., Schillewaert et al., 2005). There is a silent revolution occurring now related to how purchasers behave, and this behaviour has an evident effect on the sales side. Many things change the complexity of selling in the B2B context. For example, in the global arena, there is an increasing need for more complex products and services, and entities related to these areas are selling value. These

ventures require deeper understanding of the underpinnings related to customer value creation. Traditional selling, in many cases, has turned towards consultative selling.

The challenges around marketing have started from consumer businesses. The new digital forums, social media, and mobile marketing are typical examples of the contexts that have revolutionized marketing (Lamberton and Stephen, 2016). These types of media and their development has intensified the need to look at the issue of market intelligence in new ways.
The use of IT solutions in inter-organizational relationships has increased during the last few decades. Most articles look at these issues from the seller's side, but material from the buyer's perspective also exists. For example, Presutti (2003) studied e-procurement and defined it as "a technology solution that facilitates corporate buying using the internet." After the intensive e-procurement and e-supply period, there has been much discussion concerning IT and the Internet, and their roles in decision-making about purchasing and e-purchasing in different contexts (Centobelli et al., 2014; Walker & Brammer, 2012; Gunasekaran et al., 2009).

From the seller's point of view, IT tools enable a new way of interacting with critical parties in the distribution channel. Mirani et al. (2001 p.101) pointed out that "suppliers have traditionally managed their relationships with resellers using inefficient, fragmented, and labor-intensive communications processes." Their basic message is that multiple benefits can be received not only through improved efficiency and productivity, but also from improving profits by enhancing "front-office" activities. In many cases, including ours, this requires collaboration with distributors. Distributors do sometimes act as gatekeepers between manufacturers and customers. In this situation, it is extremely important to find solutions that are beneficial to all parties in the distribution channel.

Sales Force Automation (SFA) provides digital tools for the use of distribution networks. Jobber and Lancaster (2009) identified SFA as one of the major forces affecting selling and sales management. One SFA tool is the sales configurator. These configurators play a crucial role among companies with rather complex and technical products. In these situations, it is crucial to find the best possible product and service configurations from both the customer's and the company's perspectives. SFA refers to the use of technology by salespeople in their selling and administrative tasks (Morgan & Inks, 2001). SFA can be defined as the application of information technology to support the sales function (Buttle et al., 2006). SFA is meant to support the sales function, not to replace it; in other words, SFA means adapting technology to support the sales activities of a certain company to enhance the company's sales process.
An SFA system is often part of an enterprise-wide information system that integrates sales activities with the information systems across the whole organization (Barker et al., 2009). Therefore, SFA is vital for the whole organization. Technologies used may include, for example, computer hardware, software, and mobile devices such as tablets and mobile phones. SFA promises to free salespeople from their compulsory time-consuming administrative tasks in favor of relationship-building tasks that better suit the skills and abilities of the sales force (Eggert & Serdaroglu, 2011).

Sales configurators can be used in various ways. A typical situation involves the selling company's personnel using these configurators in their selling tasks. Distributors use them when configuring products per requests of end customers and when finalizing the product orders sent to the selling company. The most far-reaching application for the sales configurators is when sellers let the end customers define their preferences for the product attributes, thereby configuring the product themselves. Enabling the end customers be involved in the configuration process has been found to increase customer satisfaction (Huffman & Kahn,

1998). At the same time, more information can be gathered from the customers (Berman, 2002). Zanker and Tiihonen (2008) stated that a configurator creates valid configurations of a requested item based on specified criteria and limitations to ensure compatibility and customer requirements.

Although sales and product configurators are frequently viewed as interchangeable, they can have different meanings. Pimiä (2002) said that a sales configurator is a product configurator adapted for the needs of sales personnel. It is software, either an independent application or a part of another one, such as ERP, CRM, or Product Data Management (PDM), that helps the sales force to create a quotation. Then again, Kopra (2003) identified three entirely different usage scenarios for a sales configurator application: (1) internal use by a sales person to create quotations, (2) dealer use of the application, and (3) direct external use by end-customers.
According to Haag (1998), a sales configuration is a high-level configuration in which an external user, usually a sales person or a customer, interacts with an application to make a creative decision on the offering. Kopra (2003) argued that, more often, the customer accesses the configurator through the Internet to generate a configuration detailed enough for automatic quotations. More recent studies, such as that of Abbasi et al. (2013), support this claim and note that the configurator offers a graphical user interface (GUI) to guide customers through the entire process. During this process, the configurator verifies the feasibility of a configuration and handles possible conflicts (Abbasi et al., 2013).

In addition to the basic benefit of the configurator—a product that fits the customers' needs—research shows that customers can attain value from experience-related benefits (Trentin et al., 2014). According to Trentin et al. (2013), other customer-related benefits of sales configurators in business-to-consumer markets are (1) benefit-cost communication, (2) user-friendly product-space description, (3) easy comparison, (4) flexible navigation, and (5) focused navigation. In an empirical study, Baharati and Chaudhury (2006) found that both system and information quality influence the user satisfaction with sales configurators.

El Kadiri et al. (2015) have studied trends in ICT technologies and enterprise information systems (EIS). They presented four challenges of EIS: (1) data value chain management, (2) context awareness, (3) usability, interaction, and visualization, and (4) human learning and continuous education. These issues also must be considered in guided selling projects. In addition to typical IT systems like ERP, CRM, and maybe SFA, new concepts and systems have emerged in the discussion, such as Partner Relationship Management (PRM). Mirane et al. (2001) saw these systems as "helping suppliers treat resellers as virtual extensions of internal sales teams."

2.2 Development of Seller – Distributor Relationship

The relationship between seller and distributor is often critical for the success of the distribution channel. Tsai et al. (2013) stated that "in the e-Retail industry a well-designed IT infrastructure is essential in creating a tightly integrated value chain and delivering high quality service." Their article concentrates mainly on information systems and technology (IST) sourcing and underlines the essential role of IT in retail business. This may be especially critical for e-retailers, but similar performance effects can be realized in manufacturer–distributor relationships. The relevance and need to develop IT solutions that support both efficiency and effectiveness goals is evident. Osmonbekov and Gruen (2013) stated that "firms are increasingly using e-business tools to transform channel relationships in order to achieve competitive advantage." They also divided the systems into categories: (1) reseller-supplied,

(2) third-party supplied, and (3) manufacturer-supplied. In addition, they postulated that companies should be aware of perceived inequity in sharing benefits of e-business technology. The general assumption is often that benefits accrue to all parties due to effects such as lower costs, improved communications, streamlined processes, web-based accessibility, and issues surrounding channel power. Mirani et al. (2001) also discussed the IT tools in supplier-reseller partnerships.

Wilson and Daniel (2007) underlined the importance of rapid and dynamic changes in the distribution channel to be able to compete successfully. Their findings stated that there are challenges in both creating new innovative channels and at the same time ensuring that the "organisation works as a single, coherent entity" delivering consistent service.

3 METHODOLOGY

3.1 Research Design and Case Selection

The research data includes semi-structured interviews in five Finnish industrial cases. In this paper, we analyze 45 interviews that are coming from a dyadic company – distributor context. The data gathering focuses on five focal industrial case companies; two of them were offering goods and services in the field of electronics industry, while one was a machine manufacturer producing equipment used mainly in the construction industry. In addition, two workshops were aimed at professionals, and were also arranged around the research topics.

Four companies are small- and medium-sized enterprises (SMEs), and one company is considered large. Companies operate in the field where the end-products are complex and modular. All the companies market and sell products and services to global markets. Configuration is often needed according to customers' needs. The companies in the study also differ in their reliance on distributors. One company sells nearly all of its products through resellers. Two of the companies make approximately half of their sales through resellers. One company makes only a small part of its sales through resellers.

The electrical components companies sell products that are clearly configurable; this quality is critical to satisfy end-customer needs. Still, many of the products are off-the-shelf products. In those cases, the configuration is done by the distributor, the manufacturer, or a collaboration of both.

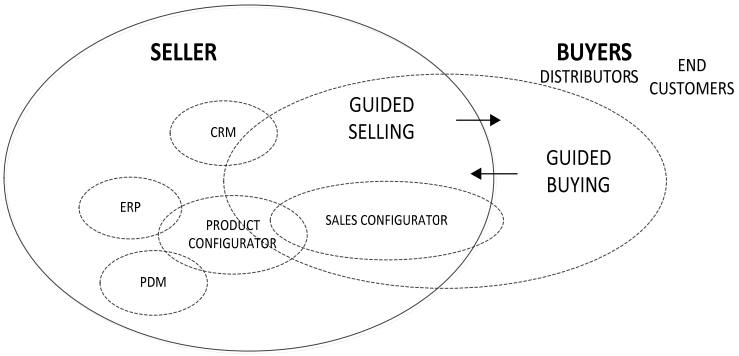

Figure 1. The setting of the study and relevant IT systems

The dyadic scope of the research can be seen in Figure 1. The selling companies (i.e., focal companies) and the buying companies (i.e., distributors) are the main foci of the study. Figure

1 also illustrates the different information systems used for guided buying and selling. In the current study, we look at the sales configurators under investigation in our study and only marginally use the term guided selling, which is a broader concept of sales using IT tools and personal selling in the distribution channel relationships.

3.3 Data Analysis

The research data was analyzed by the researchers according to the methods used in qualitative data analysis. The themes were created according to interview material in order to answer the research aim. The data included rich and colorful text by the practitioners, and this may have included some biased views and personal opinions. We tried to find the possible biases and not make any far-reaching interpretations based on these comments.

The basic data consisted of the comments made about the benefits and challenges of sales support tools by suppliers and distributors. Also, the comments related to the nature and importance of the supplier-distributor relationships were valuable. In the analysis, it was clear that the different businesses had certain similarities but also some clear differences. These interesting findings will be analyzed in the results section herein.

4 RESULTS

4.1. Benefits Driving the Development of Digital Sales Tools

The companies' representatives saw the development of the guided selling positively, and they saw many possible benefits from the use of the IT tool. The process itself enabled the development of business processes and more effective results in the whole distribution channel. The end-customer also benefited from more systematic configuration in the sales process. The nature of the tool as a checklist of important issues in the sales process was often mentioned by interviewees. Other widely mentioned benefits were the increase in product knowledge and many operational elements. When the product information is presented in a customer-friendly manner, it is cognitively more accessible. The importance of presenting technical and product information in an accessible way is particularly important in cases where the complexity of the products is great. There were examples where companies needed to go through the technical details of the order iteratively.

> *"Someone who does not know the products so well could still make the configuration so that solution is a functioning product."*

As with the selling company, the distributor would benefit from the increased information about the customers' needs, market distribution, and market potential. The benefits could come to all parties through this more transparent chain from the end-customer to producer. Easier and more efficient handling of orders is yet another benefit to the selling company. In many cases, the interviewees said that the most obvious benefits came from more efficient operations. Sometimes, the distributors stated that the most of the benefits would inure to the supplier's side:

> *"It is useful for you guys…."*

The suppliers believed there were also benefits for the distributors, as it was easier to assess the financial outcome of certain solutions. The value and cost of customizing products was revealed:

> *"The distributors could see easily in the offering phase what is their profit when including different features into the offering. They would see if it's useful to customize the products (if customer is not wishing it)."*

> *"If, for example, you buy a machine with some additional features the system would help you to specify the configuration correctly and you would avoid difficult negotiations when adding the features afterwards."*

There was also a difference between the companies already using sales configurators or electronic purchasing from the case suppliers. These companies were able to give both positive and critical feedback about the functionality and usability of the systems. On the other hand, their opinions may have been fixed on their current experiences, and it may have been difficult to solicit more visionary ideas for systems development.

The distributors' benefits can be inferred from the idea that the configurator tool would make their lives easier and support their business goals. Resellers are quite often the parties who influence the configurations suggested to the end-customers. A digital configurator could make ordering easier and faster, and it would support sales. Businesses could obtain statistical data from the sales and technical data about the products sold and their profitability, for example. Distributors could also enhance their knowledge of the products, as well as the end-customers' needs. Two benefits would be a clear view of the total offerings and an easier comparison among the different solutions.

4.2 Challenges Complicating the Development of Digital Sales Tools

When considering the pressure to transform operations, the interviewed rental company representatives saw that their roles and positions would remain largely the same as before. The IT capabilities and tools would help some operations, but would not change the business logic in a radical way. Our distributor interviews were done only in Finland, and the material discusses mainly this market area. We received some indications in internal interviews that market areas are highly different. In some markets, the role of rental companies is not as important, and the willingness and active use of IT and modern information sources (e.g., social media) differs a lot. In addition, the view of how things will be changing in the future varied widely. Some interviewees thought that there would be changes in the buying patterns and practices, while others saw the conservative business staying as it is.

In both machinery and electricity cases, it was clear in the most complicated cases—including customization and complex solutions—the expertise of the manufacturer was needed. In those situations, there is often the need for face-to-face contacts that may include all parties: distributor, end-customer, and manufacturer. The use of configuration tools is supported in the middle of the continuum, off-the-shelf products, and fully customized solutions. The view was rather similar in internal interviews, where the salespersons saw that the tools may have an effect on their work but would not eliminate the need for the salespersons' personal expertise. This opinion was supported by comments when interviewees discussed the role of face-to-face contacts:

"No configurators or IT systems can replace it (face-to-face contact)."

The use of IT and other changes in current operations are quite challenging for the manufacturing companies. There are different fears and resistance to change that make the new solutions hard to implement, even internally, for manufacturing companies. Interviewees also mentioned that the challenges can be even greater when directed towards external companies. At least the company cannot force the partners to use the systems:

"Change is a very difficult thing to us and breaking the change resistance. We should look forward and develop things even though it is difficult."

When talking about the changes in the distribution channel during the internal interviews, the general opinion was that tools have to be developed in order to keep the competitive edge in the future. There were huge differences among the current distributors and in their IT :

"I don't see it possible with current customers, but I know that things will change."

"If we want to be an active and modern company, digitalization is a must. World has developed to this direction and if we don't follow this development we are definitely out!"

The roles and positions of different companies in the distribution network may change and there may be conflicting interests.

"We try to handle things so that we are not fishing at the same place with the manufacturer. If there is a mutual customer the manufacturer deals with larger projects and we'll manage the daily needs."

The distributor's perspective is critical in most of the companies. The new tools and active use of modern IT are seen as ways of developing the distribution network. Many of the old ways of distribution are still working fine, but there has to be an ability to see future development and changing buying patterns. There is not a great risk of radically losing the business in the short term, but in the long term, this can happen. On the other hand, by implementing new tools and innovative ways of presenting offerings, new customers and new geographical areas can be found.

4.3 Summing Up Results

The study includes both sellers' and resellers' (i.e., buyers') opinions on IT tool use in their sales and purchasing operations. The natural result is that it is easier to implement the system internally with one's own salespeople than to put it in the hands of resellers and ensure active use there. This point is obvious, but it highlights the importance of developing a system to provide the benefits to different parties and users. In this context, businesses cannot rely on the systems that are released merely hoping to bring some benefits. The tools must be extremely useful. Table 1 summarizes the Benefits and challenges of sales tool implementation at different parties.

Table 1. Benefits and challenges of sales tool implementation at different parties

	B2B-Seller	B2B Seller-Distributor Relationship				B2B-Distributor
	Internal	Pre-relationship	Relationship	Relationship	Pre-relationship	Internal
Benefits and Drivers	▪ Operational efficiencies ▪ Order handling becomes easier ▪ Improved market information ▪ More resources to customer development tasks	▪ Sales tool becomes a marketing communication channel ▪ Attracting better distributors ▪ Improved market visibility	▪ Improved sales because of better customer service ▪ Sales tool supports traditional selling activities ▪ Easier and improved order generation ▪ If customer uses the tool, the customer commits to the seller	▪ More relevant information from supplier (options, profitability…) ▪ More technically oriented customers receive tools they require ▪ Information is not dependent on salesperson or time of day	▪ Supplier selection becomes easier ▪ Relevant information is available ▪ Willingness to use a sales tool can give an access to "better suppliers"	▪ Pricing becomes easier ▪ Product know-how increases ▪ Customers are easier to serve
Challenges	▪ Master data handling ▪ Updating the information ▪ Developing and Implementation of the system	▪ Information open to competitors ▪ Too much information to distributors & end customers ▪ More difficult to differentiate to different segments	▪ Educating and motivating the distributors to use the tool take resources ▪ Technological issues	▪ Learning of many information systems take resources ▪ Technological issues	▪ Initial access to sales tools can be difficult ▪ Technical know-how is required	▪ Resources need to be allocated to utilize the tools ▪ Using a specific tool can be a risk if personnel changes are expected

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Theoretical Conceptualisation of Business to Consumer Product Return Knowledge – The Case of 'End-of-Use' and 'End-of-Life' Immediate Return

Rosnida Mamat[1], Muhammad Mustafa Kamal[1], Uthayasankar Sivarajah[2], Styliani Despoudi[3] and Manoj Dora[1]

1 Brunel University, United Kingdom

2 University of Bradford, United Kingdom

3 Coventry University, United Kingdom

ABSTRACT

Consumers often tend to store non-functional and old electronic products for a period of time before they are discarded. The storage behaviour may cause by unclear communication concerning the importance of immediate return. In discussing undesired storage behaviour among consumers, this research provides insightful product return knowledge by studying the idea of ideal timing and quality of return and the effect of different message framing on consumers' Immediate Return Intention (IRI). Therefore, this research presents a conceptual framework underpinned by social marketing theory highlighting product return knowledge as a factor that influences consumers to immediately return their used products. The proposed framework also visualised the relationship between message framing and consumers' IRI that moderated by these consumers' traits; environmental knowledge and environmental motivation, resulting in facilitating the establishment of effective business-to-consumer information sharing.

Keywords: Product Return Knowledge, Message Framing, Immediate Return Intention (IRI), Social Marketing Theory

Paper Category: Working Paper (WP)

INTRODUCTION

Over the years, manufacturing activities have been mostly confined to extracting raw materials from the earth to produce end products. The products then will be disposed into landfills or incinerated after its end-of-life. However, this unsustainable approach is no longer acceptable because of the rising concern for clean and safe environment. Realizing the magnitude of this problem, various initiatives have been undertaken by industries, governments and scholars and they have tried to analyse this issue from the perspective of the supply chain and more particularly in the context of Closed Loop Supply Chains (CLSCs) (Guide and Van Wassenhove, 2009; Rubio et al., 2008; Jimenez-Para B et al., 2014). CLSCs are related to End-of-Life (EoL) and End-of-Use (EoU) products. The aforementioned research is focused on the supply side of End-of-Life (EoL) and end-of-use (EoU) and it highlights various key activities such as product acquisition, reverse logistics, inspection and possible product disposition (Blackburn et al., 2004). Focusing on value-added recovery material use cycle, one of the common problems encountered in CLSCs is uncertain quantity and quality of the return.

In the CLSCs, Original Equipment Manufacturer (OEM) or remanufacturer may decide to handle the return process individually (Madenas et al., 2014). Guide and Jayraman (2000) mentioned that 82% of firms collect the used products directly from the customers. Manufacturers know that the retailers are the closest players to the market and thus they can influence customers, create knowledge and awareness of environmental concerns, and educate them to return the products in good conditions (Giovanni, 2014; Hong and Yeh, 2012). One of the major challenges in CLSCs research is to understand its relationship with the market and consumers (Jimenez-Para et al., 2014). Particularly, (re)manufacturers are interested to know the relationships of various factors with return attitude and intention, and how these factors can motivate consumers' to immediately return their used products. Nowadays, (re)manufacturers motivate the consumers to return their EoU and EoL products through benefits such as warranty, incentives, and exchange offer. However, they are still unable to collect sufficient amount of used products from the market (Jena & Sarmah 2015). In respect of that, firms want to know the key factors which impact mostly the return attitude and intention of the consumers. Moreover, these questions are likely to be encountered by the (re)manufacturer in practice, and they have not been adequately addressed in the literature.

In discussing consumers' immediate return intention, this research investigates product return knowledge development and delivery. Product return knowledge development highlights the types of information (information content) and product return knowledge delivery highlights information presentation (information context) as independent variables. The chosen variables are derived from work by Philips (2004). Philips (2004) stated that successful environmental education depends on its design and delivery. Additionally, rational choice theory suggests that individuals base their choices on the attributes of the choice set (information content), the way information is being presented (information context) can also have a strong effect on consumers' use of and reaction to information (Avineri and Owen, 2013). Thus, this research explores the effect of types of information and information presentation on consumers' Immediate Return Intention (IRI) of durable household waste. The proposed information contents are ideal timing and acceptable quality of return. The proposed information context is message framing; positively and negatively framed messages.

Therefore, the aim of this research is to propose a conceptual framework leading to consumers' Immediate Return Intention. This framework provides information on how the identified variables influence consumers to immediately return their used products. The product return activity is discussed based on these scopes:

- Where the product return is initiated by consumers and not by curbside collection initiated by collectors (local government agencies, industrial collectors, third-party recyclers).
- The end-of-use and end-of-life product return and not focused on other types of returns (e.g. commercial return, warranty return).
- Product return that involved the returning activity of household waste such as broken and obsolete small electronic kitchen appliances, office equipment and toys and is not focused on food and beverage packaging, apparels and container.

LITERATURE REVIEW

Consumers' Storage Behaviour

According to Sabbaghi et al. (2015), consumers often have a tendency to store their used, old or un-functional electronics for a period of time before they discard them and return them back to the waste stream. Numbers of previous research highlighted this issue. Saphores et al. (2009) presented the first survey-based which estimates of e-waste items stored by US households. They found that by the end of 2005, US households stored at least 470 million

small and 277 million large electronic waste (e-waste) items, which substantially exceeded 2008 official estimates (EPA, 2008). Tackling the same issue is, Milovantseva & Saphores (2013b), who found that US households stored approximately 84.1 million junk TVs at the end of 2009. Milovantseva & Saphores (2013b) also reported that consumers tend to retain their e-waste (television) between the range of 5 to 16 years. The latter research reported a particular range of retention period based on these demographic factors: educational level, gender of household head, marital status, household income and geographic location. Recent research of Sabbaghi et al. (2015) explored storage behaviour among consumers. One of the findings reported that consumers tend to store the unwanted Hard Disk Drive (HDDs) for 1.11 years on average. Sabbaghi et al. (2015) also found that household consumers tend to keep electronic waste longer in storage when they use them less than the normal time.
Such prolonged storage behaviour as reported in the extant research leads to problems such technology obsolences for product recovery, low-efficiency disposal treatment that could danger human health and uncertainty problem in product return and recovery inventory. Regardless of functionality, the obsolete used products are not likely to be reusable (Babbitt et al., 2016). This behavior increases the obsolescence rate of used still-functional products which will directly affect the further treatments such as reuse, upgrade, and refurbishment. The obsolete waste then might be dumped in landfill sites or recycled with low-efficiency such as being burnt for valuable metals which results in releasing of hazardous toxics into the environment and harmful effects on human health (Jang and Townsend, 2003, Kolias et al., 2014). These are the reasons why immediate post-consumption return is vital. According to Guiltinan (2015), consumers need to know time delay in collecting and processing products makes them unusable, obsolete and even completely unsalvageable. This means that knowledge about technological obsolescence should be transferred to consumers so that they will initiate immediate post-consumption return. Consumers need to know that the sooner a used product is processed, the higher value is recovered. Optimal recovery value is beneficial for businesses and also helps in minimizing the risk to human health. It is time to view this issue from a social-good point of view. Understanding the nature of the used electronics in terms of quality and timing will diminish the risk of unprofitability of recovery system as well as avoid hazardous disposal that could harm our health (Sabbaghi et al. 2015).

Despite the fact that producers come up with numerous strategies to respond to reverse logistics, such as product take-back policy, extending the scope of producer responsibility, incentive-based scheme (refund payment) to encourage more return, it still insufficient. Consumers' willingness to commit in immediate return after usage phase is necessary. Any kind of motivation and knowledge sharing could be one of the solutions to encourage willingness and participation. Additionally, Sabbaghi et al. (2015) also suggested that manufacturers should play vital role in motivating consumers to return their household waste, especially e-waste.

Business-To-Consumer (B2C) Information Sharing in EOU and EOL Return
In B2B information sharing, accurate, timely, and consistent information about material flows and processes through the supply chain can reduce operating costs and increase the productivity of individual companies and the entire supply chain (Timpe, 2006; Uusijarvi, 2010). In the other hand, for B2C information sharing, consumers value detailed product information, especially in pre-purchase processes, e.g. product origin, quality, sustainable characteristics (Regatteri et al., 2007) and post-consumption processes (Appelhanz et al. 2015). B2C information sharing can reduce consumers' information asymmetries and associated information costs (Hobbs, 2013; van Amstel et al., 2014), thereby increasing product trust and purchase intentions (Chen et al., 2012; Clemens, 2013; Ortega et al., 2014;

Ubilava and Foster, 2012). The provision of these types of information enhances trust in products as well as preferences for eco-friendly and abstinence from non-eco-friendly materials (Gleim et al., 2013). Good pro-environmental messages not only draw the customers closer to pursuit long-term and profitable relationship (Bendapudi & Leone, 2003; Payne, Storbacka, Frow, & Knox, 2009), but it ultimately results in positive behavioral intentions from consumers (Viet & Cass 2013). Hence, it will result in consumer engagement in pro-environmental behaviours, such as sustainable consumption and disposal.

Products return knowledge with immediate return information is expected to respond the exponential growth of durable household waste, for example, e-waste. It is easier to solve the exponential growth of e-waste by using drop-off method, instead of take-back program and curbside collection. By definition, drop-off recycling method means that consumers willingly drop their waste at the provided facilities. On the other hand, take-back program and curbside collection are the collection method that initiated by (re)manufacturers, government or other third parties. Drop-off recycling is easier to implement than take-back or other programs involving manufacturers and the required facilities are typically less expensive to operate than curbside collection programs (Saphores et al. 2012). In order to amplify return initiated by the consumer, awareness is vital. According to Jena & Sarmah (2015), to spread awareness among the consumers for returning their used products is a challenging issue for the (re) manufacturer. Nonetheless, this issue is challenging yet attainable. It is attainable with the support of adequate and accurate information throughout educational programs and campaigns, plus the familiarity of general environmental knowledge among consumers. Since today's consumers appreciate general environmental knowledge more than ever, the distribution of this type of specific environmental knowledge is possible.

CONCEPTUAL BACKGROUND AND PROPOSITION DEVELOPMENT

Product Return Knowledge

Generally, return product knowledge is an individual's knowledge and familiarity about returning the used products. It can be measured in terms of objective or subjective knowledge, which is very difficult to separate operationally (Rao and Monroe, 1988). Thus, a composite multiple scale knowledge on subjective and objective analysis is used to measure the return product knowledge as quality, performance, and price (Rao and Monroe, 1988). To fit in this research context, return product knowledge is extended by considering some special features of returned product knowledge like availability of collection of used products centre, recovery process and existence of toxic material in electric and electronic equipment. These special features are related to information derived from Guide and Van Wassenhove (2009), which highlighting time and quality of return. Specifically, knowledge about the existence of toxic material in electric and electronic equipment reflects the importance of returning electronic waste as soon as possible (ideal timing of return). For the acceptable quality of return, it will be implicitly conveyed in knowledge about recovery process of electronic waste.

There is evidence that general environmental knowledge is not always a sufficient condition to predict environmentally conscious consumer behavior (e.g., Laroche et al., 2001; Polonsky et al., 2012). This suggests that product specific environmental knowledge such as environmental labels providing appropriate and accurate information is also an important requirement to allow consumers for making environmentally conscious and reasoned decisions (Polonsky et al., 2012; Testa et al., 2013). For this, consumers must know about the existence of environmental knowledge, understand their meaning, and trust the information presented (Thøgersen, 2000). Bougherara and Combris (2009, p. 321) define environmental

knowledge as information tools that "aim to internalize the external effects on the environment of the production, consumption, and disposal of products". Based on these findings, this research attempts to highlight the usage of specific environmental knowledge, which is product return knowledge as a tool to affect consumers' action in products disposal.

Here, the construct 'knowledge' is meant to measure consumers' familiarity with the functional aspects of environmental message (Taufique et al., 2014) and the meaning of different terms used in. Based on this discussion, the following is proposed:

P1: Product return knowledge is positively related to attitudes towards EoL and EoU immediate return

Immediate Return Attitude

Many studies establish attitude as one of the strong antecedents influencing behavior (e.g., Ballantyne & Packer, 2005). In most models of pro-environmental behavior, attitude is placed as the central variable between environmental knowledge and behavior (Davies et al., 2002; Polonsky et al., 2012) where environmental knowledge and pro-environmental attitudes are highly interconnected (Bamberg, 2003). In this research, attitude towards the environment is measured in terms of consumers' degree of agreement in the inclusion and availability of relevant information (ideal timing and acceptable quality) of EoL and EoU return.

Immediate Return Intention

Intention is an individual's planning of action to perform the behavior, and also captures the motivational factors that influence the behavioral attitude. A person's behavioral intention is conjointly determined by attitude and subjective nor norm, which assists to measure the actual behavior of a person (Fishbein and Ajzen, 1975; Wang et al., 2013). Return intention has been in discussion, for example in Jena & Sarmah (2015), which highlight numbers of construct that affect return attitude and intention. Examples of construct that derived from qualitative literature reviews are perceived benefit, perceived risk, return product knowledge, social awareness, subjective norm and market characteristic. Based on the finding from qualitative literature reviews, this research adopts two of the constructs; return product knowledge and social awareness. Return product knowledge for this research covers extended features from previous literature. Previous literature cover the features like availability of collection centers and energy saving. Additionally, this research covers the extended features like recovery process. Therefore, it is suggested that:

P2: Attitudes toward EoL and EoU immediate return is positively related to immediate return intention

For this research, social awareness is another construct that can influence immediate research intention. In this research context, social awareness is defined to assess the information about immediately return the used products from different sources. Consumers' assessed this information from various sources such as friends, advertisement, and education (Raziuddin et al. (2016); Chang & Wu (2015); Lai et al. (2014)). Based on this, social awareness is implicitly presented in the message framing part of this research. Relevant information and different information presentation play an important role in making awareness among the consumers about the return of used products (Jungbluth et al. 2012). Therefore, this research intends to answer this question:

"How does consumers' immediate return intention change after being manipulated by two differently framed awareness messages?"

Message Framing in Product Return Knowledge

Literature presents two methods of presenting environmental information and knowledge, such as *environmental labels* (Mackenzie, 1991; Harris and Cole, 2003; Horne, 2014), and *message framing* (Avineri and Owen, 2013; Chang and Wu, 2015). An environmental label is a visual method that companies and manufacturers use to display the environmentally preferable features of a product in the marketplace (Goggin, 1994). As for message framing, scholars define it as a theoretically grounded persuasive communication strategy aimed at promoting perceptions, judgments, attitude and behavioural changes through the presentation of equivalent appeals, framed in terms of either the benefits gained or negative consequences incurred (Chang and Lee, 2009; De Velde et al., 2010; Gerend and Cullen, 2008; Krishnamurthy et al., 2001; Levin et al., 1998).

Message used in communicating environmental impact of particular products when they are not properly treated and disposed could be presented in positive and negative ways. In this study, consumers' participation in product return activity can be promoted by emphasizing the positive consequences of doing so (for example, *"if you decide to return your no-longer used appliances for proper treatment and disposal, you will help the environment"*) or the potential negative consequences of not doing so (for example, *"if you decide not to return your no-longer used appliances for proper treatment and disposal, you will harm the environment"*). These two approaches have the same goal, which is encouraging participation in product return activity.

The rationale of having these two ways of information presentation is both of them having different effects on individual behaviour. Considering this fact, marketers design different advertising methods and products to tackle different segmentation in their commercial marketing. Segmentation aims to identify whether unique groups (segments) exist along with key needs and motives that distinguish each group to inform different marketing and promotion mixes accordingly (Andreasen, 1995).

In the study of charitable activities and environmental protection, scholars tend to be inclined to believe that a negative message is more influential, as there is a negativity bias when processing information (Chang and Lee, 2009; Davis, 1995; Levin et al., 1998). Taylor (1991) indicates that negatively framed messages are more direct, differentiated, and contagious than positively framed messages, and make people feel fear, anxiety, unhappiness, and strong and rapid physiological, cognitive, emotional, and social responses. These reactions, however, are not created in the same intensity by positive message framing (Banks et al., 1995; Van't Riet et al., 2010). When proprietors provide a negatively framed message, the consumer's emotions are aroused because the messages contain information regarding potentially negative consequences (Chang and Lee, 2009; Mayer et al., 1992). Hence, based on the aforementioned discussions the following is proposed:

P3: A negatively framed message will be more effective than positively framed message when promoting immediate return of electronic waste

The Moderators

This paper presents a conceptual framework that investigates the relationship between product return knowledge and consumers' EoL/EoU immediate return intention. Two moderator roles are highlighted which are *environmental motivation* and *environmental knowledge*. These moderators will be used to define consumers' segmentation. Previous literature defined

environmental motivation as individual's level of motivation toward environmentally friendly behaviours (see e.g., Osbaldiston and Sheldon, 2003; Pelletier et al., 1998; Villacorta et al., 2003). Deci and Ryan (1985) noted that concept of environmental motivation stems from the innate psychological needs for competence and self-determination. Individual practices pro-environmental behaviour for different reasons. Therefore, motivation has been proposed as a means to gain insight into varieties of behavioural persistence (De Young, 1986; Pelletier et al., 1998).

As for environmental knowledge, scholars define it as a general knowledge about environmental issues or problems, such as the problems the earth is now facing (Benton, 1994; DeChano, 2006; Martin and Simintiras, 1995). Additionally, Petty and Cacioppo, (1986) noted that environmental knowledge can be defined as an individual's ability to interpret and process information. The selection of moderators, which are environmental motivation and environmental knowledge, is based on attributes of intrapersonal level in an individual. According to Frias et al., (2008), individual motivation and ability affect the outcome of message processing. Ability is another definition of environmental knowledge as noted by Petty and Cacioppo (1986). Fewer studies have investigated whether the differences in personal motivation and ability interfere with the emotional reaction of the individual when reading positive and negative messages, and subsequently influence behaviour (Chang and Wu 2015). Therefore, environmental motivation and environmental knowledge are selected as the moderator based on the following assumption:

Where there is a sense of environmental motivation and environmental knowledge (even in very low level), consumers will spend time to read environmental information of products.

When motivation is high, the individual will need to employ a greater proportion of cognitive resources in order to assimilate the message. Furthermore, if the individual received a negatively framed message, he or her emotions will generate an additive effect, because people have more motivation to avoid a loss than to attain a gain of equal magnitude (Krishnamurthy et al., 2001; Meyerowitz and Chaiken, 1987). Therefore, they will prefer information about potential negative consequences and ways to avoid their occurrence (Chang and Lee, 2009). Consequently, he or she will be more concerned over the message content, and relevance to environmental protection will be processed in more detail when a message is negatively rather than positively framed (Kanouse, 1984; Maheswaran and Meyers-Levy, 1990; Steward et al., 2003). Hence, the negativity bias will exert its influence. Based on this discussion and to achieve the aforementioned objectives of this paper; to examine the two-way interaction effect between message framing and environmental motivation, the following hypotheses are proposed:

P4: A negatively framed message is more persuasive for immediate return in situations of high environmental motivation

P5: message framing has no differences in persuasiveness effect for immediate return in situation of low environmental motivation

This study also attempts to achieve this objective; to decide whether positively or negatively framed message is more effective in appealing for electronic waste immediate return (controlled by environmental motivation and environmental knowledge). When an individual with high motivation and more knowledge performs a behavior, he or she prefers engaging in environmental goals and also has the ability to select information with higher relevance to his

or her needs, and so understanding will be more efficient and with less effort. Hence, the individual will have confidence in his or her ability to perform the specific behavior (Ajzen and Madden, 1986; Frías et al., 2008; Kidwell and Jewell, 2008). Because the individual already has relatively high environmental knowledge, he or she can effectively deal with the message. Therefore, there is not much difference in pro-environmental behavior intention whether the message is framed positively or negatively.

On the contrary, an individual with high motivation and low environmental knowledge is likely to systematically or thoroughly process the given information. Because they (him or her) concerned environment, and have high environmental motivation, therefore, him or her carefully attends, evaluates, elaborates, and integrates task relevant environmental informational inputs, and base their environmental awareness on their understanding of such information. In other word, negatively framed message is more effective for individual who has high environmental motivation and low environmental knowledge. Hence, the following hypotheses are proposed:

P6: message framing has no differences in persuasiveness effect for immediate return in situation of high environmental motivation and high environmental knowledge

P7: negatively framed message is more persuasive for immediate return in situations of high environmental motivation and low environmental knowledge

Conceptual Framework

The proposed conceptual framework covers the aspects of information content (types of information) and information context (the way information is being presented). These aspects belong to two level of supply chain communication, which are from point of origin (producers or manufacturers) to point of consumption (consumers). At manufacturer level, the Product Return and Recovery Management (PRRM) takes place in order to achieve one ultimate goal; profitable return and recovery operation. Profitable return and recovery mean that the operation achieves operational cost minimisation and profit maximisation. At consumers' level, environmental knowledge and environmental motivation are selected to be the additional factor to modify their current return practice. This means that consumers willingly commit to immediate return, instead of storing the used products. The modification in consumers' current return practice; from return to immediately return the used products is based on behavioral change, one of the benchmark criteria suggested in social marketing theory. The ultimate goal of social marketing should be to change people's behaviour, not only to inform and educate them about social problem (Kubacki et al. 2015).

In the context of the proposed conceptual framework as seen in Figure 2, the process of translating return and recovery information (information content) into persuasive and understandable context (presentation) is to promote the action of immediate EoL and EoU return among consumers. The identified research gap (as shown in Figure 1) in this translation process is regarding the right timing of return and acceptable quality of return. At present, environmental product information that available for consumer covers only the environmental effects caused by the products in the phase of manufacturing and use (Jungbluth et al., 2011a). Immediate EoL and EoU return is expected to be attainable if consumers are provided with the correct and clear information of product return and recovery. The correct and clear information is expected to encourage consumers' willingness to return their used products to the provided drop-off sites, not in domestic waste bins.

The benchmark criteria, formative research, as suggested by social marketing theory (Andreasen, 2002), is used to identify consumer preference towards return and recovery information (time and quality of return) in product return creation. The identification of relevant product return and recovery information, then, will lead to the process of translating the information into understandable environmental message format. The rationale of understanding types of information that valued by consumers is to avoid information overload. It has been noted that providing a huge number of product information items might result in an information overload; it therefore becomes necessary to identify the items consumers especially value (Kehagia et al., 2007; Pieniak et al., 2013; Salaün and Flores, 2001; Verbeke, 2005, 2008). As the information consumers demand might vary between consumer segments, the valued information items also should be determined for different target groups (Dimara and Skuras, 2003; Verbeke, 2005, 2008). Based on this, the proposed framework is considering the segmentation, as one of the fundamental elements suggested in social marketing theory. Formative research also used in identifying consumers' preferred information presentation. The information presentation is required to influence and convince consumers to take further action in product return activity. Considering the fact of interpretation difference, two presentation methods and two personal moderators are included in the framework. The positively and negatively framed messages are the presentation methods suggested by framing message concept. The aforementioned moderators, environmental motivation and environmental knowledge are derived from previous environmental behavioural studies (Chang and Wu 2015; Weinstein et al., 2015; Lois et al., 2015).

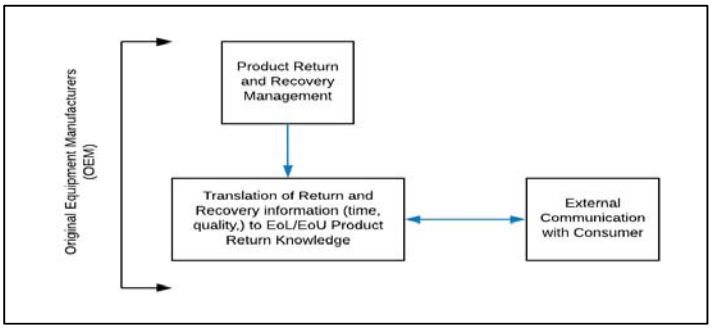

Figure 1: Research Gap

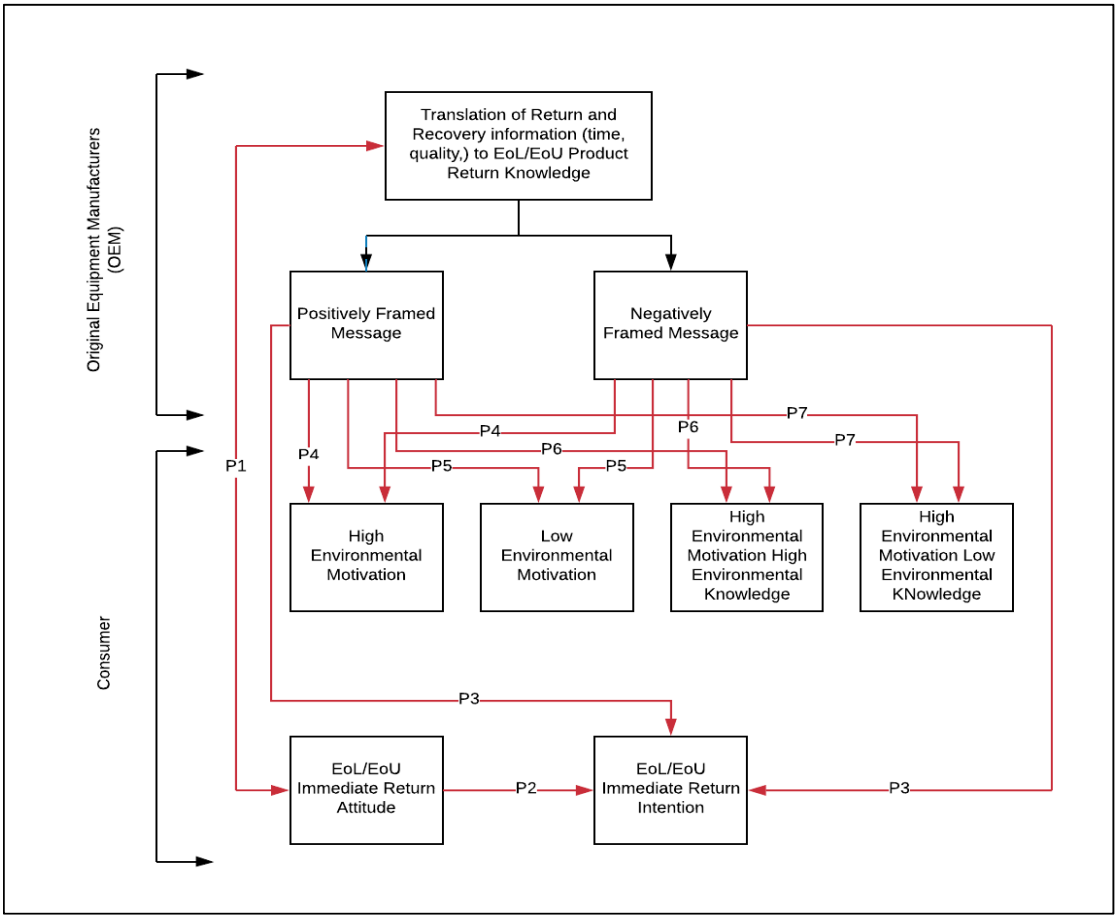

Figure 2: Conceptual Framework

RESEARCH DESIGN

The first thing that will take place in order to collect primary data for validation purpose is designing the framing message. Briefly, there will be two short messages of approximately 150 words, conveying the advantages (message 1: positive frame) and disadvantages (message 2: negative frame) of returning the acceptable quality used products at the right time. Messages post-validation phase will include the design of a survey that completed by these influential measures; demographic, environmental motivation, environmental knowledge, product return knowledge, immediate return attitude and immediate return intention.

Influential Measures

- **Demographic:** According to Chang and Lee (2009), these factors may influence the likelihood of green initiatives; age, gender, and educational level. These related demographics were deliberated as potential variables that might influence the survey's results.
- **Environmental Knowledge:** Environmental knowledge is an individual's skill or proficiency in interpreting the information contained in a given stimulus (Frías et al., 2008; Maclnnis et al., 1991). To do this, the Roper Group assessment on basic environmental literacy (Coyle, 2004; DeChano, 2006) and scale from the 1997 survey administered by the

National Environmental Education and Training Foundation (NEETF) are referred. To measure respondents' proficiency, the proficiency criterion at 75 percent correct will be used, as suggested by NEETF.

- **Product Return Knowledge:** product return knowledge will be assessed based on four items which cover the idea of EoL and EoU return, respondent's familiarity with the collection center and why they need to return the used electric and electronic equipment. The four items use 6-point Likert-style scale. The four items adapted from Hazen et al (2012) and Jimenez-Para et al. (2014). The items were reworded to meet the context of this research.
- **Environmental Motivation:** Environmental motivation assessment will be conducted by using six subscales of motivation toward environmentally friendly behaviours as suggested by Osbaldiston and Sheldon, (2003), Pelletier et al., (1998), and Villacorta et al., (2003). On a seven-point scale, respondents will be asked to rate the degree to which they agree with the elements. The scale and all elements are derived from Pelletier et al., (1998). The intended outcome of this section is an environmental motivation index. The index is expected to help in exhibiting two levels of environmental motivation, which are high and low.
- **Informative Measure:** Participants indicated how true, objective, convincing, relevant, believable, useful, and interesting the message was to them. Ratings were made on seven-point scales (Chang and Lee, 2009; Van't Riet et al., 2010). An index was created by calculating the mean of the seven items.
- **Immediate Return Attitude:** In this study, attitude towards immediate return is measured based on four items that were developed by Lee (2011) on six-point Likert-style scale. Adapted items were reworded, where necessary, to maintain the semantic properties of the context of the study.
- **Immediate Return Intentions:** Assessment for immediate return intentions covers the respondents' likelihood of supporting immediate return. The five-point scale of "always willing", "sometimes willing", "unsure", "rarely willing", and "never willing" (Kilbourne and Pickett, 2008) will be used for this assessment.

CONCLUSIONS

This paper has pursued to bridge the literature void in terms of B2C information sharing that is expected to influence consumers' participation in product return activity. The aim of this research has been achieved by proposing a conceptual framework to explore how product return information and its presentation could possibly influence the information processing at consumers' level, so that it is understandable and influential to encourage participation in immediately returning used products after end-of-use and end-of-life phases. The framework was developed based on social marketing theory. The next step as part of this research is to empirically validate the conceptual framework and its respective propositions.

Theoretical Contributions

This research is expected to contribute to the introduction of subsets in segmentation as the addition to geographic (e.g. cities, countries) and demographic (e.g. sex, age, education) segmentation in social marketing theory. In addition to demographic segmentation suggested in social marketing theory, this research explores the propositions that use environmental motivation and environmental knowledge for segmentation purpose. The propositions will be tested by using motivation index and environmental literacy calculation. These formulas show

that intrinsic elements (motivation) and ability (knowledge) are measurable and they are relevant to be used as the basis of segmentation.

Practical Implication

Additionally, this research initiates the exploration of Business-to-Business (B2B) related information; ideal timing and quantity of return, into B2C communication and its potential to amplify drop-off recycling. Last but not least, this research contributes in introducing the concept of Immediate Return Intention, which based on behavioral change, one of the benchmark criteria suggested in the social marketing theory.

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Network Governance and Sustainability Diffusion: Global versus Local Solutions to Sustainability in Food Supply Networks

Leonardo Marques
The COPPEAD Graduate School of Business, Rua Pascoal Lemme 355, Rio de Janeiro, RJ, 21941-918, Brazil, leo.marques@coppead.ufrj.br, tel. +5521 39389800, fax +5521 25989817

Rebecca Arkader
The COPPEAD Graduate School of Business, Rua Pascoal Lemme 355, Rio de Janeiro, RJ, 21941-918, Brazil, rebecca@coppead.ufrj.br, tel. +5521 39389800, fax +5521 25989817

Abstract

A redefinition of sustainability considers the natural environment and society as constraints to firms. The food sector is characterized by buying firm power and experiences pressures from food scarcity on the environment side and transparency demands on the societal side. This paper postulates that sustainable supply chain management should incorporate new theoretical lens to understand the dynamic shifts of network governance modes occurring in the food sector. Drawing upon global value chain, resource-dependence theory and embeddedness, this essay proposes a research agenda for the analysis of global and local solutions to food supply and the impact onto sustainability diffusion.

Keywords: Sustainability, Food Supply Networks, Network Governance

Introduction: Sustainable supply chain management and the food sector challenges

Current definitions of sustainability within the Sustainable Supply Chain Management (SSCM) literature have been predominantly based on a temporal perspective (Matos & Hall, 2007; Reuter et al., 2012; Schrettle et al., 2014), a multi-dimensional perspective (Seuring & Müller, 2008), or both (Carter & Rogers, 2008). The temporal perspective is grounded in the Brundtland Commission's definition of sustainable development: *"development that meets the needs of the present without compromising the ability of future generations to meet their needs"* (WCED, 1987, p. 8). From a business perspective, this definition suggests that firms need to consider both short-term and long-term results. As a result, the strategic management of resources must consider not only short-term efficiency but also long-term continuity of supply (Pagell et al., 2010).

The multi-dimensional perspective has often been grounded in the triple bottom line concept (Elkington, 1998), which defines sustainability as a three-dimensional construct balancing the dimensions of economic, environmental and social impact. Nevertheless, preliminary SSCM frameworks have often taken a two-dimensional focus to explore tensions either between the economic and environmental dimensions, or between the economic and societal issues (Wang & Sarkis, 2013). The former approach often uses the term 'green', such as in 'green supply chain management' (Srivastava, 2007), whereas the latter focuses on corporate social responsibility, such as in 'socially responsible supply chain management' (Hoejmose et al., 2013). The year 2008 became a milestone in the definition of SSCM based on the three-dimensional concept of sustainability, as captured by two influential reviews by Carter and Rogers (2008) and Seuring and Müller (2008), respectively:

SSCM by Carter and Rogers (2008, p. 368): "*The strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systematic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains* ".

SSCM by Seuring and Müller (2008, p. 1700): "*The management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account, which are derived from customer and stakeholder requirements".*

The food sector is particularly pressured by health and environment protection requirements that raise challenges such as food security, water security, clean energy and biodiversity (Griggs et al., 2013). As such, it has been increasingly the object of studies in the SSCM field. Moreover, a recent redefinition of sustainability questions the balanced perspective proposed by the triple bottom line and reframes the three pillars paradigm as a *nested concept* (see Figure 1). This new paradigm sets the natural environment and social development as constraints to economic performance (Griggs et al., 2013).

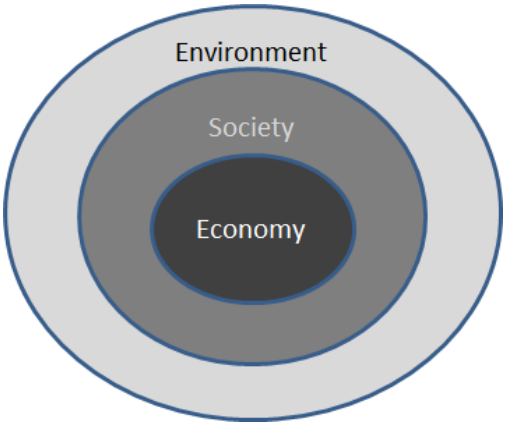

Figure 1: The nested concept, adapted from Griggs et al., 2013.

The food sector has been largely affected by increasing social and environmental constraints, in particular regarding the threat of food scarcity. On one hand, forecasts suggest that as population growth continues, by 2050 the world will need to feed more than nine billion people, requiring nearly 70% more food than what is consumed today (Denis et al., 2015). On the other hand, because food production requires vast amounts of natural resources, such as water, land and energy, it represents a particularly significant challenge regarding energy consumption (Mena et al., 2014). Moreover, in the US alone, the increase in coastal storms will cause US$ 3-7 billion in annual damages to food businesses by 2030 (Paulson Jr., 2015). As society becomes aware of growing concerns on food scarcity and food safety, governments have been closely observing the practices of the food industry, and the sustainability of the food system has been under increasing scrutiny from the public (Beske et al., 2014).

Although current definitions still emphasize the 'chain' perspective, recent studies have indicated that the increasing complexity and fragmentation of supply systems suggest the need to reframe SSCM in at least two main aspects. Firstly, by expanding the scope of SSCM

from the linearity of direct buyer-supplier relationships to multi-tier and multilateral studies (Walker et al., 2014). Secondly, by exploring the differences across local and global systems, in order to capture the inherent complexities of global supply networks (Tachizawa & Wong, 2014) and to provide further understanding of SSCM phenomena outside the context of large-to-large firms (Touboulic & Walker, 2015a).

This paper takes an essay format to first, reflect on the limited debate regarding the differences between global and local solutions to food supply, then set theoretical foundations based on theories that have so far have seen limited application in the SSCM field, namely, global value chains, resource-dependence theory and embeddedness. Finally, the essay draws from anecdotal evidence in food supply networks in the US and Brazil to illustrate the research questions that compose a future research agenda for the field.

The incipient debate on global versus local food supply

Global solutions to sustainability in the food sector

Food supply networks are predominantly characterized by concentration of power within a small set of buying firms (Gereffi & Lee, 2012). The rise of global food supply networks has resulted from the co-evolution of the geography of consumption and the geography of production (Gereffi et al., 2005). The former has been shaped by the increasing purchasing power of emerging economies, which has expanded the consumer market available to large (and global) firms, previously restricted to rich countries. The latter has been shaped by the increasing costs of land, labor and capital, which have set large firms on a continuous quest for low-cost sources of goods and services, moving their sourcing targets from rich countries to emerging countries (Rodrigue, 2012). The resulting configuration is a fragmented and globally dispersed supply network. Food distribution is particularly representative of this trend, creating the equivalent of a *supply funnel,* where *large buying firms*[i] are in the center of consumer goods distribution, channeling food products from a globally dispersed supply base to an even wider base of end-consumers around the globe (Gereffi & Lee, 2012).

The continuous search for low cost sources of supply and the fragmentation of the upstream side of global food supply networks (i.e. the supply base) have led to a multi-tiered structure composed of *direct suppliers*, often geographically close to the buying firm; and *sub-suppliers*, mostly concentrated in emerging economies, thus distant from Western buying firms (Rodrigue, 2012). The increasing participation of emerging economies in global trade has drawn attention to the socio-environmental impact of sub-suppliers, pushing buying firms to improve sustainability standards not only within their boundaries and direct suppliers but also throughout their extended supply networks (Grimm et al., 2014). Moreover, because sub-suppliers are often globally dispersed small and medium-sized suppliers (SME suppliers[ii]), large buying firms have often turned to the adoption of global codes of conduct in order to improve sustainability standards (Turker & Altuntas, 2014). In such global supply networks, major buying firms may be deemed to be no more sustainable than their suppliers (Krause et al., 2009). As such, a buying firm's sustainability profile is constituted not only by its own practices, but also by those of its direct suppliers and of its extended global supply chain (Miemczyk et al., 2012). This reality is perhaps most starkly demonstrated by the reputational (and financial) damage caused to a number of organizations by media exposure of unsatisfactory ethical behavior or environmental performance by key suppliers (Svensson, 2009).

SSCM research has put most of its recent attention on global supply networks, as well as on the discussion of obstacles to the management of suppliers from emerging countries (e.g. Awaysheh & Klassen, 2010; Chen & Hung, 2014; Ehrgott et al., 2011; Gold et al., 2013; Hall

& Matos, 2010). As sustainability pressures show no signs of abating and firms have insufficient knowledge and capabilities to tackle all sustainability issues, these must cooperate with stakeholders across the broader supply network (Zhu et al., 2008). Moreover, buying firms are being increasingly impelled to lead the diffusion of best practices throughout their global supply networks (Nair et al., 2016).

Local solutions to sustainability in the food sector

Triggered by public scrutiny of global food supply networks and the disappointing responses from large buying firms, solutions based on local food production and distribution have been increasingly presented as a sustainable alternative to global systems. In many countries, local food producers are organizing cooperatives and local markets that can directly access end-consumers and offer them an alternative to mainstream food distribution. As food cooperatives are often led by entrepreneurs and small-sized firms, these systems face multiple difficulties inherent to their size, financial constraints, and limited access to resources and knowledge possessed by larger firms (Capo-Vicedo & Capo, 2011).

Small firms are more likely than large firms to encounter significant obstacles when attempting to introduce SSCM practices (Barnes & Liao, 2012). Cooperation with other similar sized firms is a strategic alternative that can offer smallholder farms a better competitive position (Capo-Vicedo & Capo, 2011). Cooperative systems are based on the principles of autonomy and self-direction. Autonomy means that the supply network runs with no single company deliberately orchestrating the totality of its activities (Choi et al., 2001). This means that governance within supply networks may be a self-organized and emergent process (Nair et al., 2016). In opposition to the centralized coordination seen in global supply networks led by large buying firms, self-directed networks may exhibit higher levels of participation, offering a low cost alternative to monitoring and formal controls (Alvarez et al., 2010).

The unstable nature of emergent cooperatives produces a transient aspect in business relationships, which may vary between adversarial and collaborative (Bastl et al., 2013). Cooperative members, which are competitors to some extent, may interact among themselves by means of autonomous relationships (Choi et al., 2001). The analysis of interactions among suppliers may reveal how they can cooperate and jointly organize economic action, despite being competitors (Mena et al., 2013). Co-opetition has been defined as *"the inherent tension of cooperation and competition: in other words, increasing gains through collaborative synergy while at the same time fighting for larger shares of the gain"* (Wilhelm, 2011, p. 663). Although originally focused on the economic dimension, co-opetition can entail *"cooperation among competing entities to achieve economic, environmental or social goals"* (Pathak et al., 2014, p. 266). SCM scholars have begun to explore co-opetition, but often within the context of dyadic buyer-supplier or supplier-supplier relationships (Wu & Choi, 2005). There is limited research looking beyond the dyad and examining coopetition in supply networks (Kim et al., 2011). Moreover, the network composition of such cooperatives differs greatly from supply networks led by a central buying firm, yet they are almost unmapped by the SSCM literature.

Tensions between global and local solutions to sustainability in the food sectors

The differences sketched above have led to the emergence of a 'local' versus 'global' debate concerning world food distribution. Nevertheless, the extant SSCM literature has been shy in addressing this research avenue (Touboulic & Walker, 2015b). To address this research gap, this essay elaborates on how the global value chain framework (Gereffi et al., 2005),

resource-dependence theory (Pfeffer & Salancik, 1978) and the concept of embeddedness (Granovetter, 1985) can work as complementary theories to discuss how future research can address the alternative governance modes in local and global food supply networks in order to understand how they influence sustainability diffusion.

Theoretical foundations to inform a research agenda

Supply network dynamics are underexplored in SSCM literature and have received little research attention (Nair et al., 2016); hence, the SSCM field may lack adequate theorization to investigate alternative governance modes with very different network compositions which represent the differences between global and local solutions to food sustainability. Theory choice in SSCM studies has favored mostly transaction cost economics (TCE), the resource-based view (RBV) and stakeholder theory (Touboulic & Walker, 2015c). Influenced by these theories, the extant SSCM literature has predominantly taken a dyadic perspective (Miemczyk et al., 2012) and assigned a protagonist role to major buying firms, assigning a secondary role to suppliers, and particularly to sub-suppliers (Grimm et al., 2014).

This essay subscribes to calls in the SSCM field to: (a) explicitly state the theory informing research (Touboulic & Walker, 2015c) and (b) benefit from the richness of general theories under-explored within the SSCM field (Sarkis et al., 2011). The tradition of borrowing theoretical perspectives from other disciplines and the mother field of general management has influenced the way in which SSCM has been conceptualized, but there are still unexplored opportunities, as well as unanswered questions (Sarkis et al., 2011). Drawing from established theories within general management literature can avoid 'reinventing the wheel′ (Touboulic & Walker, 2015c). Moreover, this approach enables a twofold theoretical contribution: (i) applying an established theory to SSCM phenomena offers a new context to elaborate on the original theory to address idiosyncrasies of the new context; and (ii) using a new theoretical lens to investigate SSCM phenomena is an opportunity to contribute to the SSCM field.

Global value chains

Global value chains (GVC) is a theoretical framework developed to explain value appropriation and the dynamics of geographical configuration of global supply networks (Gereffi et al., 2005). GVC studies have been often published outside traditional OM journals, such as the Journal of Business Ethics (e.g. Lim & Phillips, 2008; Rotter et al., 2014), and little SSCM research has been conducted adopting the GVC lens (Gereffi & Lee, 2012). Drawing from the TCE framework, the GVC framework proposes *market* and *hierarchy* as the two extremes of a governance mechanism continuum (Williamson, 2008). Differently from the TCE framework, in between the two poles of market and hierarchy, the GVC framework discusses alternative governance modes and power asymmetries between buyers and suppliers according to three variables: (i) complexity of transactions, (ii) the ability to codify transactions, and (iii) the capabilities in the supply network (Gereffi et al., 2005). The framework posits that higher levels of complexity, low levels of ability to codify transactions and lack of capabilities within the supply base favor buyer-driven supply chains, i.e. buying firm control over the supply base; whereas an opposite scenario favors an equilibrium between buyers and suppliers (Gereffi et al., 2005). Depending on the level of buying firm control over the supply base, governance may assume *relational*, *modular* or *captive* modes (Gereffi et al., 2005). A *modular* governance reflects a reasonable coordination balance between the buying firm and suppliers, skewed towards the buyer; a

captive governance reflects full coordination by the buying firm, whilst the *relational* mode rests in between (Sturgeon et al., 2008).

GVC explains shifts of governance mode through top-down and bottom-up movements. Top-down movements reflect global buying firms' imposition of practices and profit distribution, whereas bottom-up movements reflect responses from local producers, associations, and other stakeholders in search for upgrading, i.e. accessing value-added activities and improving economic results for the local economy (Gereffi et al., 2005). The food sector is a major focus of GVC literature, and has been historically characterized by buyer-driven supply chains and a captive governance mode, meaning major buying firms such as retailers and brand-name food manufacturers dictate guidelines and define profit margins upstream and along the supply chain (Gereffi & Lee, 2012). GVC posits that buyer-driven supply chains emerged from the shift of power from producers to buyers, resulting from the consolidation of major retailers and brand-name manufacturers in the food sector (Gereffi et al., 2005). Nevertheless, the GVC literature so far has not considered movements where local producers gather to form cooperatives to reach out directly to final consumers, and in what ways such movements could reshape governance modes and provide new opportunities for social upgrading.

We conjecture that these movements are related not only to value appropriation, but also to sustainability diffusion. Therefore, we resort to GVC as an adequate theoretical background for understanding the local versus global debate, but also posit that such research avenue can contribute to the development of the GVC framework, as they might lead to a swing back to supplier-driven supply chains. Furthermore, we also suggest that this pendulum between buyer-driven and supplier-driven governance can be seen through the lens of resource dependence and response to constraints, which we explore next.

Resource-dependence theory

Resource-dependence theory (RDT) explains how the business environment affects and constrains firms as well as how they respond to these external constraints (Pfeffer & Salancik, 1978). When the environment changes, firms face the prospect of either not surviving or changing in response. According to RDT, behind every constraint there is an interest (stakeholder) group. What stakeholder theory (which is out of the scope of this study) defines as stakeholder pressure, RDT labels as an external constraint. Hence, RDT can help to explain large buying firms' reaction to food scarcity as well as food suppliers' reaction to lack of access to final consumers and well as reduced margins, hence RDT can contribute to the global versus local debate.

RDT suggests the level of resource dependence depends on two elements: resource importance and concentration of resource control. In order to reduce uncertainty, firms increase coordination with key stakeholders, increasing interdependence, which in turn reduces uncertainty (Pfeffer & Salancik, 1978). Hence, the threat of supply scarcity imposes an external constraint for the buying firm that, according to RDT, will make it invest in closer relationships with the supply network. Additionally, excessive concentration of resource control will see the buying firm increasingly moving beyond the first tier of suppliers to develop supplier loyalty with upstream producers. Furthermore, RDT proposes two responses to external constraints: *advocator* (influencing the environment) and *processor* (adapting to the environment) (Pfeffer & Salancik, 1978). While the former reflects an active approach to mitigating or eliminating constraints, the latter refers to a more passive response to changes in the environment.

We conjecture that the previously-mentioned pendulum between buyer-driven and supplier-driven supply chains might reflect opposite responses on each side, from a RDT perspective. In other words: large buying firms have been adopting an active/advocator

approach for the last decades, resulting in a reactive/processor approach by suppliers, where recently, the rapid expansion of local cooperatives signifies an active/advocator approach by suppliers, possibly resulting in the buying firms shifting to a reactive/processor approach. However, despite the promising contribution that both GVC and RDT might offer to SSCM in the food sector and more specifically the global versus local debate, the inherent complexity, messiness and decentralization of supply networks characterized by SMEs call for a third theoretical perspective, namely the concept of embeddedness.

Embeddedness

An insightful view for understanding the contrast between well-established networks and emergent networks is the concept of *embeddedness* (Granovetter, 1985), which posits that firm behavior is embedded in, or partially determined by ongoing systems of interfirm relations. The word "partially" in the description is important, because it signals the view that firms' economic behavior should be seen as neither under-socialized nor over-socialized (Simsek, 2003). Emergent networks are fragile systems, and in opposition to established clusters, they are more exposed to unethical behavior (Eckerd & Hill, 2012). Local clusters develop a system of norms over time that influences the decision-making process and favors group-level over individual benefits (Dyer & Nobeoka, 2000). As a result, dense clusters are influenced by non-economic logics of association, since supply network members are embedded in culture, values and beliefs. Such a process is defined as cultural embeddedness; hence, non-economic forces can counter-balance market forces during the decision-making process (Wu & Pullman, 2015). Within embedded networks, there is active and widespread participation of all members, negotiating and collaborating towards a common goal.

In this essay, we infer that decision processes in centralized supply networks led by large buying firms will differ largely from those in decentralized food cooperatives. In addition, given that the GVC framework has been developed with a focus on the role of buying firm, it may fail to explain messy dynamics in food cooperatives. Hence, we propose to resort to embeddedness in order to complement the picture initially drawn using GVC and RDT.

Towards a research agenda on network governance and sustainability diffusion

A combined lens to analyze global food supply networks

Initially, we suggest a GVC lens to get a better understanding of governance and sustainability diffusion in global food supply networks. When studying such networks, the SSCM literature has extensively investigated relationships between focal buying firms and their direct suppliers by contrasting two alternative approaches: monitoring and collaboration (Gimenez & Sierra, 2013; Gimenez & Tachizawa, 2012; Tachizawa et al., 2015; Vachon & Klassen, 2006, 2007, 2008). When broadening the scope from local to global supply networks (and managing sub-suppliers), SSCM research has suggested that managerial practices have similar characteristics to those applied to direct suppliers (Grimm et al., 2014).

When expanding monitoring mechanisms to sub-suppliers, buying firms have often adopted indirect or third-party solutions (Tachizawa & Wong, 2014). Generally in a dominant position, large buying firms have adopted a centralized strategy of sustainability targets and guidelines for suppliers (Banterle et al., 2013), imposing global standards and targets onto the supply base (Caniëls et al., 2013). However, there are two main challenges that make managing sub-suppliers unique. The first is incomplete traceability due to the lack of transparency about the existence and involvement of sub-suppliers in a buying firm's supply base (Grimm et al., 2014). The second is the lack of contractual relationships with sub-

suppliers, limiting the buying firm's ability to put direct pressure on them (Grimm et al., 2014).

Collaborative efforts involving globally dispersed sub-suppliers have faced as much resistance as monitoring mechanisms. The geographic dispersion of global supply networks adds complexity to collaborative efforts due to differences in culture (Grekova et al., 2014), economic background (Hall & Matos, 2010) and institutions (Parmigiani & Rivera-Santos, 2015; Silvestre, 2015). Such heterogeneity hinders collaboration (Hall & Matos, 2010). Furthermore, the more globally dispersed the networks become, the less buying firms can influence sub-suppliers (Hoejmose et al., 2013). Barriers to the diffusion of best practices are amplified when considering the relationships between a large corporation and SME suppliers (Lee & Klassen, 2008). Hence, whilst collaboration seems an effective pathway to SSCM, how to develop a collaborative environment remains an answered question, particularly when considering the large share of SME suppliers (Touboulic & Walker, 2015a) and the geographic dispersion of contemporary supply networks (Alvarez et al., 2010; Rotter et al., 2014). Previous research has emphasized the significant challenges faced by large buying firms engaging with globally dispersed SMEs, such as in the cases of Nestlé (Alvarez et al., 2010) and Danone (Gold et al., 2013).

In brief, collaboration between large firms and globally dispersed SMEs seems a complex yet under-explored aspect in SSCM. On the positive side of SME involvement, despite the investment capacity of large firms, SME suppliers are often in a better position to innovate due to their inherent agility (Balch, 2016). On the negative side, many SME suppliers face difficulties in meeting the increasing social and environmental guidelines of their customer firms, given their limitations in financial funds and human resource expertise (Lee & Klassen, 2008).

The GVC literature has characterized food supply networks with low levels of ability to codify transactions and lack of capabilities within the supply base, hence leading to the formation of captive governance (Gereffi & Lee, 2012). In captive supply networks, large buying firms should be able to impose sustainability standards onto their supply base of SME suppliers. Nevertheless, recent research shows high levels of supplier resistance within supply networks characterized by the presence of strong buying firms (Muller et al., 2012). There is a dark side of excessive buying firm coordination, where sustainability efforts that (a) are characterized by uneven distribution of benefits/risks and (b) are implemented in a mandated fashion suffer resistance from the dominated suppliers (Brockhaus et al., 2013). Moreover, existing buyer-supplier tensions in periodic commercial negotiations are also a barrier to collaboration (Touboulic & Walker, 2015a). Furthermore, SME suppliers often do not possess the skills, resources and time to comply (Touboulic & Walker, 2015a).

The limits to sustainability diffusion in global food supply networks might be explained by RDT (Pfeffer & Salancik, 1978). First, despite being in a captive mode, SME suppliers may succeed in impose some level of external constraints to the buying firm. Second, the imposition of sustainability standards onto captive suppliers may backfire and increase resistance, hence increasing external constraints. Third, the threat of food scarcity may be promoting a shift of power, which may impose in a governance shift from captive to relational or modular governance alternatives. In other words, SME suppliers may experience a power rebalance due to food scarcity, increasing their strength and imposing onto buying firms the need to shift from an advocator approach to a processor approach. Moreover, SME suppliers seem to realize they can use this power to gather into cooperatives, which may either lead to the emergence of an equivalent of modular governance in food supply networks, or some new form of governance, unmapped by the existing GVC framework and characterized by the predominance of local solutions to food supply.

A combined lens to analyze local food supply networks

Through the GVC lens, the emergence of local food cooperatives directly accessing end-consumers may be rebalance of coordination mechanisms, which will lead to a rebalance of value appropriation by smallholder farms. In other words, the emergence of food cooperatives reflects a process of disintermediation (Mena et al., 2013), which can cause buying firms to lose the broker position in the supply networks. Nonetheless, the resulting emergent reconfiguration may differ from governance modes currently offered in the extant GVC literature. To RDT lens, this shift is more specifically a power shift, where suppliers can now act as advocators, thus reshaping the environment.

Despite the lack of understanding of the emergent process of new cooperatives of SME suppliers, a recent study by Wu and Pullman (2015) analyzes a 22-year old US cooperative of beef producers. According to the authors, throughout the years, the decision-making process has been largely influenced by the strong cultural ties among cooperative members (Wu & Pullman, 2015). Hence, the emergence of new cooperatives may suffer from a lack of cultural ties if cooperative participants do not share common backgrounds. Ultimately, the level of embeddedness within such cooperatives may define the success of such local solutions to food supply.

Besides the US, Brazil is also experiencing the emergence of many food cooperatives. Between 1995 and 2012, Brazil has gained 15 places in McKinsey's globalization index (Manyika et al., 2014), hence a proof of increased globalization in general across economic sectors. But, at the same time, looking at the food sector, sales of local food cooperatives have grown close to US$ 1 billion in 2015 (Fischberg, 2015). The ascending trend is in part driven by a growing, although still slow, interest in organic/bio foods, especially in larger, more sophisticated urban markets, like São Paulo and Rio de Janeiro, and sales of organic products have allegedly reached US$ 1 billion in 2016. By recent expert accounts (Liu, 2017), while 82 percent of US families consumed organic food in 2016, this proportion drops to 15 percent in Brazilian market. The US figures are not surprising and help to explain the recent widely publicized acquisition of the Whole Foods chain by Amazon. This scenario suggests a strong tension between global and local solutions to food distribution not only in the US, but also in Brazil, and most probably in other countries.

One exemplar is the Brazilian-based cooperative Junta Local (which in Portuguese has a similar meaning to "Local Cooperative"), which is one of the many emerging local food cooperatives that offer end-consumers direct access to farmers in Rio de Janeiro, the second largest city in Brazil, with over 8 million inhabitants. Junta Local was initiated in 2014 by three founders that felt difficulties in obtaining access to organic food farmers in an urban city such as Rio de Janeiro. The cooperative faces the challenge of establishing a participative and collaborative governance mechanism that gives voice to the multiple farmers, whilst providing a winning experience for end-consumers. Currently, Junta Local represents over 200 local farmers and sells products directly to end-consumers through two complementary channels. In the first option, end-consumers may buy online and collect goods once every other Saturday in a temporary hub in a rich neighborhood of Rio de Janeiro. The second options results from food fairs that the cooperative organizes every month, where end-consumers can be face-to-face with producers.

Another recent experience in Brazil is the Clube Orgânico (Organic Club), founded in Rio de Janeiro in 2014 by two advertising professionals interested in expanding the local organic equitable food market. After experimenting with different approaches for their venture, they came upon a "Community Sustaining Agriculture" model. In this high involvement model, consumers and producers undertake an obligation respectively to consume a fixed weekly

amount of produce and to produce under strict sustainable practices, with the club providing the link between consumers and producers. They initially gathered over 100 members.

In terms of the environmental dimension, in both examples the distance from *'farm to fork'* is significantly reduced, hence most probably reducing the carbon footprint of the food supply network. In terms of the social dimension, farmers, under different formats, engage in upgrading opportunities by adding services and advancing onto the retailing function previously monopolized by the large buying firms. If benefits in both social end environmental dimensions are sustained, and economic growth continues, such local solutions to food supply may offer a challenging alternative to large buying firms. A significant force of local cooperatives is the embeddedness resulting from the transparency culture where end-consumers meet farmers and buy food whose origin they trust.

Combining multiple theories to inform a research agenda

Table 1 offers a research agenda resulting from the combination of GVC, RDT and Embeddedness applied to the debate between global and food solutions to sustainable food supply.

Table 1: Food supply network governance structure and sustainability diffusion: Local versus global solutions

Theory	Construct	**Global food supply / Weak supply base**	**Local food supply / Powerful supply base**
GVC	Complexity of transactions	High	Shift to low (Less intermediates)
	Ability to codify transactions	Low	Medium (Less complexity)
	Capabilities in the supply network	Low	High (Empowered suppliers)
RDT	Prevalent governance mode	Captive	- Does this shift represent a change to Relational/ Modular governance or new governance modes?
	Response to external constraints	Buyer: Advocator Supplier: Processor	- Does power rebalance mean a swap of roles between buying firms and suppliers?
Embedded-ness	Main logic of association	Economic logics: Strong	- What is the influence of cultural/ non-economic logics onto sustainability diffusion?
	Heterogeneity of actors	High heterogeneity	- Can local cooperatives produce widespread embeddedness across the supply network?
Sustainability diffusion	Social dimension	- Limited compliance to global standards	- To what extent do local cooperatives offer social upgrading opportunities for suppliers?
		- Unbalance in value appropriation	- What is the new configuration of value appropriation?
			- What are possible positive/negative social outcomes, when compared to global solutions?
	Environmental dimension	- Limited compliance to global standards	- To what extent do local solutions reduce the carbon footprint?
		- High carbon footprint	- What are possible positive/negative environmental outcomes, when compared to global solutions?

Conclusion, limitations and future research

As the definition of sustainability has been recently revised (Griggs et al., 2013) and current SSCM theorization has been challenged (Matthews et al., 2016), this paper raises awareness to unexplored research questions regarding the trade-offs between global and local solutions to sustainable food supply. Given the current challenges of the food sector, where the environment imperative offers scaling challenges and, on one side, major firms and power concentration have been exposed to public scrutiny; and on the other side, alternative governance modes based on local supply continue to spread, there is a lack of theoretical frameworks that can help unveiling the extent to which alternative governance modes affect sustainability diffusion in different ways.

On the theoretical front, this essay offers a research agenda to motivate studies to map how different governance modes can affect sustainability diffusion. The essay builds on the logics of GVC, RDT and embeddedness to compare global food supply networks led by major buying firms with local direct-access food cooperatives. By organizing the global versus local debate through a multi-theoretical lens, this conceptual piece raises a key set of research questions that, once answered, can help unveil the extent to which alternative governance modes can set new directions to food sustainability diffusion.

In terms of managerial implications, this paper posits that the investigation of alternative governance is key to unveil the extent that local solutions to food supply can provide upgrading opportunities for farmers when they incorporate value-adding activities such as retailing and service, hence increasing their share in the value chain. As many farmers increasingly adopt the local cooperative as their sole access to market, the proposed research agenda becomes critical to provide practical recommendations not only to entrepreneur farmers, but also to funding agencies and regulators.

Despite the promising potential of 'theoretical cross-fertilization'(Gold et al., 2013), special attention must be paid to the relation between theory and context. Moreover, every theory is grounded in epistemological and ontological assumptions; hence, specific theories amplify certain concepts and relationships whilst ignoring others. This essay has purposively emphasized constructs from the three-selected theoretical lens, such as governance, transactions, response to external constraints and logic of association. Nevertheless, before considering the addition of other constructs, the framework should be exposed to empirical testing in future studies.

Most importantly, future research can provide a social contribution by supporting the empowerment of local farmers and an alternative system that may serve many end-consumers eager to understand where their food comes from and whether the price they pay for their food is equally distributed among the involved economic actors.

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[i] *This study adopts the term 'buying firm' as a standalone noun and 'buyer' when addressing widely used expressions such as 'buyer-supplier relationships'. In all cases, the term refers to the firm, not the individual purchasing professional. Furthermore, instead of adopting the terms 'multinational corporations' or 'multinational enterprises', this study uses the term 'large buying firm' to emphasize the focus on the upstream movements of large multinationals.*

[ii] *This study adopts the expression 'SME suppliers' instead of the general term 'SMEs' to highlight both (a) the size difference between large buying firms and suppliers and (b) the focus on the upstream relationships between large buying firms and their supply bases.*

Supply Chain Disclosure Drivers and Outcomes: 16 Case Studies

Donna Marshall (donna.marshall@ucd.ie)
UCD College of Business
University College Dublin,
Dublin,
Ireland
+353 1 716 8808

Lucy McCarthy
Queens Management School
Queens University
Belfast,
UK

Paul McGrath
UCD College of Business
University College Dublin
Dublin,
Ireland

Abstract
This study focuses on the growing phenomenon of public supply chain information disclosure. As this literature is still in its infancy, we adopt an inductive approach to build theory. The paper draws on data from 16 in-depth case studies across four industries to present a conceptual model of supply chain information disclosure including the drivers, barriers and outcomes of supply chain disclosure.

Key words: Supply Chain Disclosure, Sustainable Supply Chains, transparency, abductive research.

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Introduction

This paper draws on the emerging supply chain information disclosure literature to understand the present state of supply chain disclosure. Supply chain information disclosure is a relatively new phenomenon and is gaining traction in terms of research and managerial interest. Research suggests supply chain reporting is done in a messy, complex and, sometimes, incomprehensible manner (Van Der Ploeg and Vanclay, 2013; Wilson, 2013). The data is also gathered at considerable cost to both a buying firm and its extended supply chain (Marshall et al., 2016) leading to claims of exclusion and imperialism especially when reporting is demanded by large multinational companies (Mol, 2015). Given the new nature of this research area, we need to improve of understanding of the nature and dynamics of supply chain information disclosure.

To aid conceptual clarity we locate our work within the existing field: Transparency. Transparency, as a construct, was explored intermittently in the organizational sciences beginning in the early 1990s (Schnackenberg and Tomlinson, 2014). Schnackenberg and Tomlinson (2014) highlight a number of core features of transparency: it involves internal and external information exchange; it is an intentional activity; it is a perceptual process governed by the perceived adequacy and accessibility of information; it is deemed to have a positive

effect on performance, and in particular stakeholder trust. Disclosure is similar to transparency but is different in one fundamental way: disclosure occurs publicly. We use Etzioni's definition of transparency as "*the principle of enabling* ***the public*** *to gain information about the operations and structures of a given entity*" (Etzioni, 2010: 1).

Within this broad construct, we delve into one of its associated dimensions: disclosure with a specific focus on the public disclosure of supply chain information. Disclosure, along with clarity and accuracy, is generally regarded as a central dimension of transparency (Schnackenberg & Tomlinson, 2014: 1792) and encompasses a range of processes including analysis, interpretation, documentation and communication (Williams, 2008). The concept of disclosure is based on the idea that information must, at minimum, be openly and timely shared if it is to be considered transparent.

A useful starting point here is Williams' definition of corporate disclosure as "*any purposeful public release of information – financial, social or environmental, required or voluntary, qualitative or quantitative – that is likely to have an impact on the company's performance and on the strategic decision making of its internal and external audiences*" (2008: 237). While there is a considerable literature on the topic of information disclosure in general, there is no unifying theory and there are a range of ongoing disagreements about what disclosure is and what should be the proper disciplinary and theoretical focus, e.g. stakeholder theory, legitimacy theory or a communication perspective (Williams, 2008). This is attributed, in part, to the eclectic disciplinary heterogeneity of disclosure studies ranging from accounting, finance, economics, and latterly management sciences such as corporate governance and supply chain. Definitional problems also exist particularly with regard to forms of disclosure, for example, the distinction between mandatory and voluntary disclosures (Gray *et al*., 2001); types of disclosure (social, environmental and financial); their manner of the release formal written disclosures; informal disclosures (e.g. sustainability reports or websites); or inadvertent disclosures (e.g. whistleblowing) (Williams, 2008). The growing use of voluntary disclosure is deemed to be a way for firms to differentiate themselves from competitors and potentially generate financial and social outcomes for the firm through their legitimacy-enhancing or preserving effect (Cheney and Christensen, 2001). Currently, most social and environmental reporting remains voluntary (Deegan, 2002). There is also the added complication that top managers have discretion in making decisions about what information to disclose and this level of strategic choice needs to be factored into any explanatory model.

Turning to the supply chain literature, the issue of disclosure is addressed in an eclectic manner since the early 2000s. In general, we find that the supply chain literature tends to conflate the terms transparency and disclosure or subsume disclosure as part of the definition of transparency. For example, Egels-Zandén *et al*., define transparency as "*disclosure of information*" (2015: 95), with supply chain transparency encompassing information disclosure on traceability, sustainability and purchasing practices. Within this definitional perspective Egels-Zandén *et al*., differentiate between internal supply chain transparency (the degree to which a firm is transparent to itself) and external transparency (the degree to which a firm makes itself transparent to external stakeholders) (2015). In a similar vein, Mol define transparency as "*environmental governance by disclosure*" (2015: 154), with four types of supply chain transparency: management, regulatory, consumer and public transparency (2015: 155). It is the latter two forms that we encompass under the term supply chain information disclosure. Other authors use different labels for supply chain information disclosure including supply chain reporting (Mol, 2015; Wilson, 2013); or, the most prevalent nomenclature, supply chain disclosure (Deegan & Islam, 2014; Doorey, 2011; Van Der Ploeg and Vanclay, 2013).

Within the transparency literature there is a predominant focus on internal supply chain information disclosure (usually information exchange between a buyer and a supplier) and a relative neglect of external supply chain information disclosure. Although internal supply

chain transparency is well explored, the dynamics underpinning the public disclosure of supply chain information is poorly researched and understood and it is this gap we wish to address.

Methodology

Given the nascent stage of supply chain information disclosure research, we conducted an exploratory study to help develop a theoretical foundation and to understand the dynamics of the motivation, barriers and outcomes of supply chain information disclosure. A case study methodology was chosen as it allows us to investigate a contemporary phenomenon within its real-life context (Yin, 2003: 3). We chose this exploratory approach to make sense of unstructured data and gain understanding of this under-explored phenomenon. Having found no existing theory that suitably explains supply chain information disclosure we follow Eisenhardt and Graebner's (2007) protocol on building theory from case studies. This allows us to generate theoretical constructs from multiple case studies, thus developing theory inductively using replication logic (Eisenhardt, 1989; Eisenhardt and Graebner, 2007).

We explore the key questions of 'why' companies are disclosing information into the public domain (what are the drivers and barriers) and what are the outcomes (Eisenhardt and Graebner, 2007).

Sampling

Multiple cases are generally accepted as providing a stronger base for theory building (Yin, 2003). Through this approach, we are better able to argue for replication and more robust theory building (Eisenhardt and Graebner, 2007). 16 multinational companies with multi-billion euro revenues were selected as cases from the following four industries apparel (A), electronics (E), medical devices (M) and pharmaceuticals (P). These companies were selected from the Forbes list of companies on the advice of an EY report (2014) that stated that companies with multi-billion-dollar revenues were disclosing sustainability information publicly, as no report has evaluated supply chain information, we assume this to hold for supply chain information. Annual reports were examined for revenue (above €1 billion in turnover) and industry (from one of four industries of interest) with at least one company in each industry reporting some supply chain information in the public domain.

Data was gathered over a period of two years from September 2013 to September 2015 in order to evaluate companies supply chain disclosure during and after this period. The period of time was of particular interest as many companies had begun disclosing supply chain information that had not been disclosed before. Acknowledging the importance of time and context (Meredith, 1998), the chosen time frame, in our view, is critical for supply chain disclosure research.

While we expected our choice of companies to produce similar results, we were aware that institutional pressures would likely create disparities across industries due to varying institutional pressures. Using multiple cases allows for greater external validity and more robust theory building (Eisenhardt and Graebner, 2007; Yin 2003). Industry groupings allowed for further understanding of those that disclose supply chain information, who are customer facing and have been involved in a number of scandals (Apparel and Electronics) and those that are more business facing, disclose minimal amounts of information, have had fewer scandals and are heavily regulated (Medical Devices and Pharmaceuticals).

For each company we purposefully targeted and interviewed those who were responsible for supply chain information disclosure, the choice of such knowledgeable informants allows us to limit bias. In total 33 respondents were interviewed as detailed in Table 1. 15 interviewees are in companies that do not disclose any supply chain information to the public, 7 have limited information mentioning their supply chains, while 11 are in companies

that publish multiple types of supply chain information. Ethical considerations allow for the names and titles to be changed to protect the anonymity of sources.

Table 1: Cases and interviews

1	A1	Head of Supply Chain and Sustainability	Apparel Retailer	N
2	A2	Head of Sustainability	Apparel Retailer	Y
3	A2	Supply Chain Manager	Apparel Retailer	Y
4	A3	Sustainability Manager	Apparel Retailer	Y
5	A3	Sustainability Manager	Apparel Retailer	Y
6	A4	Sustainability Manager	Apparel Retailer	Y
7	A4	Supply Chain Manager	Apparel Retailer	Y
8	E1	Sustainable Supply Chain Manager	Electronics/IT	Y
9	E1	Head of Communications	Electronics/IT	Y
10	E1	Supply Chain Director	Electronics/IT	Y
11	E2	Sustainability Director	Electronics/IT	Limited
12	E2	Sustainability Manager	Electronics/IT	Limited
13	E3	Supply Chain Director	Electronics/IT	N
14	E3	Supply Chain Manager	Electronics/IT	N
15	E4	Sustainability Communications Manager	Electronics/IT	Y
16	E4	Sustainable Supply Chain Manager	Electronics/IT	Y
17	M1	Supply Chain Manager	Medical Devices	Limited
18	M1	Supply Chain Manager	Medical Devices	Limited
19	M2	Supply Chain Manager	Medical Devices	N
20	M2	Supply Chain Manager	Medical Devices	N
21	M3	Sustainability Manager	Medical Devices	N
22	M3	Supply Chain Director	Medical Devices	N
23	M4	Supply Chain Manager	Medical Devices	N
24	M4	Supply Chain Manager	Medical Devices	N
25	P1	Associate Supply Chain Director	Pharmaceuticals	N
26	P1	Supply Chain Director	Pharmaceuticals	N
27	P2	Communications Director	Pharmaceuticals	N
28	P2	Supply Chain Director	Pharmaceuticals	N
29	P3	Head of Supply Chain	Pharmaceuticals	Limited
30	P3	Head of Communications	Pharmaceuticals	Limited
31	P3	Head of Sustainable Supply Chain	Pharmaceuticals	Limited
32	P4	Supply Chain Manager	Pharmaceuticals	N
33	P4	Sustainability Manager	Pharmaceuticals	N

Data collection

A semi-structured interview protocol was used to collect the data, questions were loosely structured around the shift to information disclosure looking at antecedents, types of information disclosure and outcomes. 33 interviews between 1 and 2 hours in length were conducted and recorded. Levels of information disclosure were probed in terms of depth of information gathered and released and the number of tiers of suppliers from which information was gathered and publicly disclosed. We worked within a very broad spectrum of topics. Although there are numerous advocates of unstructured fieldwork (Spradely, 1979) for clarity and to avoid information overload we followed a more structured approach. Eisenhardt and Graebner (2007) illustrate the difficulties in suspending knowledge of the subject.

Data analysis

The research team gained access to multiple companies in four different industries leading to both theoretical and literal replication and the ability to test themes and insights are they emerged (Yin, 2003).

All the interviews were transcribed verbatim coding over 1,300 pages of transcripts. Three researchers worked in isolation following a thematic analysis approach which offers a systematic, yet flexible and accessible, approach to analyse qualitative data (Braun and Clarke

2006). This allows for an inductive approach where themes are derived from the data. To reach a consensus on what was emerging from the data we followed a rigorous, iterative approach encompassing constant comparison techniques and interpretive analysis.

This constituted the open-coding process where data was allowed to dictate emerging codes. Following Strauss' (1987) approach we were able to work within broad categories to guide the process. After the initial coding allowed us to perform the first level of analysis we met to discuss codes, refining and collapsing as we progressed. We returned to analysis establishing relationships between codes searching for links and themes within the data. Over a series of meetings, we worked to reach a consensus on what was emerging from the data.

Findings

The model in Fig. 1 depicts the initial findings of the case studies. The cross-case analysis demonstrates a consistent view of supply chain information disclosure. The majority of constructs depicted are the topics most often discussed by the interviewees with between 30%-96% agreement. The circle size shows the order of magnitude of the number of interviewees who discussed the theme, those in **bold** are over 50% agreement. We group the themes into meta-categories of driving, barriers, not driving and outcomes. We capture inter-relationships as much as possible. Within the meta-categories, where circles overlap, the same interviewee has discussed the constructs as linked in some way. Unfortunately, sometimes this was not possible to capture fully due placement and complexity. The colour of the circles is for visual clarity only.

Driving supply chain information disclosure

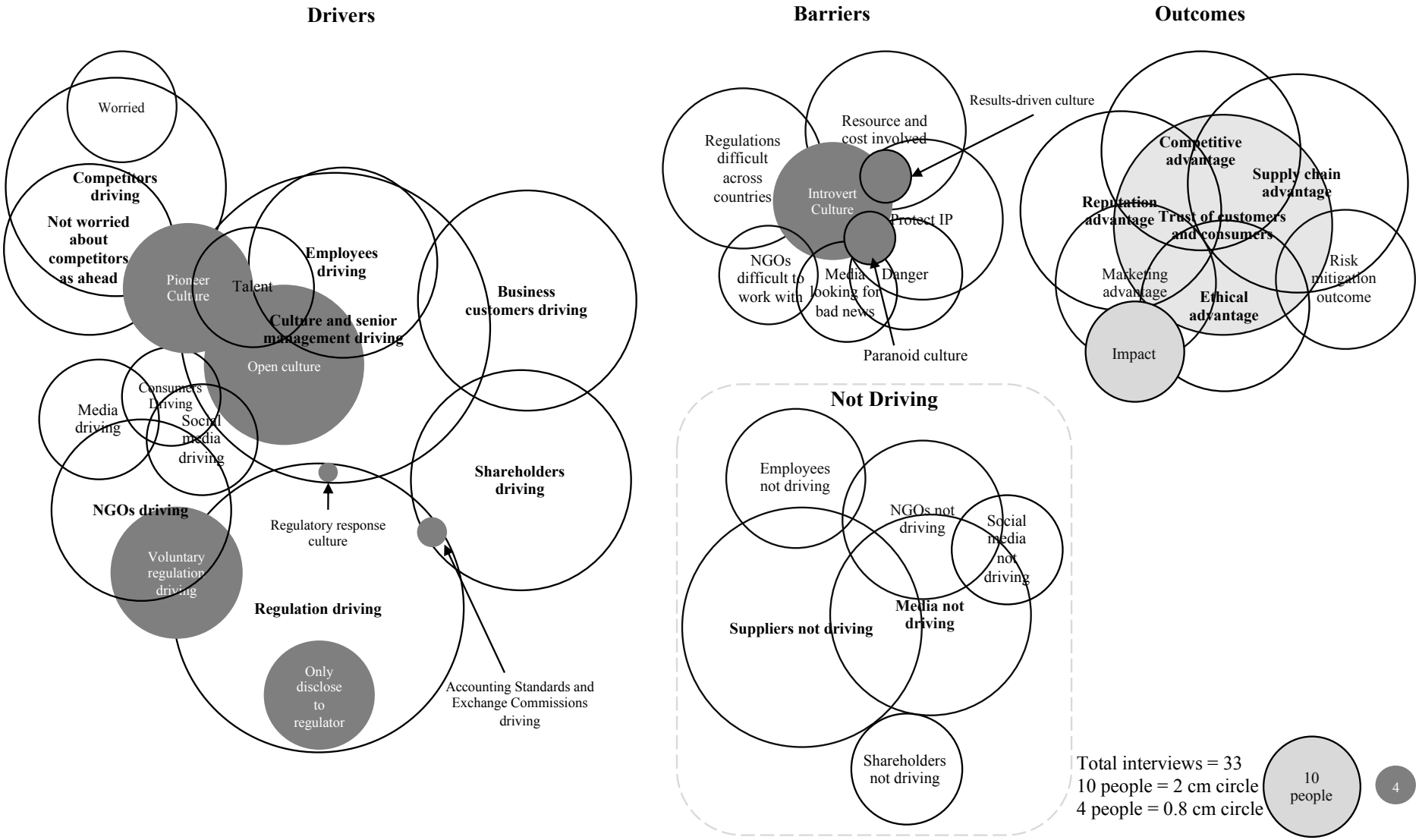
The only driver mentioned by all the interviewees was corporate culture and senior management. Previously separate constructs for senior management and culture were collapsed when 93% of respondents stated that senior management and culture together drive supply chain information disclosure. Several constructs provide detail on the types of culture: open and pioneer cultures drive disclosure, with respondents stating that building culture through multiple methods needs to happen. This also links with employees driving disclosure. In companies with a culture and senior management team who prioritise disclosure, employees are demanding more information and want to be associated with an ethical company. The need for both talent attraction and retention drives companies to disclose material issues in their supply chains.

Competitors are an important driver with some worried and others not worried about competitors as they are ahead of the competition and only use them to benchmark and pioneer new initiatives. This links competitor pressure with an internal pioneer culture, a sense that competitors are driving elite companies to be even better or more innovative in their disclosure.

87% of respondents stated regulation drives disclosure and, within this, voluntary regulations are important, particularly global initiatives such as the United Nations Global Compact and NGO-driven initiatives such as Sedex, Electronics Industry Citizenship Coalition, Fair Labor Association, Ethical Trade Initiative and Sustainable Apparel Coalition.

This links with NGOs driving disclosure and social media, consumers and media providing a compelling force for opening supply chain information. Interestingly, respondents overwhelming favour the use of social media, which is regarded as much more controllable as opposed to the unpredictable and, seemingly malevolent, nature of traditional media.

Figure 1: Supply Chain Information Disclosure Model Development



The difference between the interviewees descriptions of consumers and business customers is marked. Many more companies are under pressure from business customers to supply information, when these customers are large, sophisticated public or private sector companies. The pressure from consumers is much more amorphous with the real push for disclosure coming from NGOs who then drive consumer awareness and activism.

Four constructs are included due to their interesting nature. They are mechanisms which motivate or discourage disclosure. Cultural types that motivate disclosure: regulatory response culture; or create barriers to disclosure: paranoid and results-driven cultures. A further construct describing the impact of Accounting Standards and Exchange Commissions also intersects shareholders and regulation driving disclosure.

Barriers

The barriers to disclosure are mentioned by fewer interviewees than the main drivers. The barriers mentioned most often are the need to protect competitive advantage and intellectual property (IP), the resource and cost involved in disclosing and the difficulty in following regulations across different countries. Again, these constructs are interconnected, particularly costs and protection of IP. Several cultural constructs are also mentioned, notably an introvert culture, where the company is not used to 'broadcasting' lots of information but in some cases has used this culture to its benefit by ensuring data integrity before disclosing. However, other interviewees report this culture stems from a sense of disclosure as dangerous, the media only looking for bad news, the difficulties of working with NGOS and two other cultural attributes: an orientation for financial results and a culture of paranoia where interviewees feel that the media and NGOs attack them. This combination is a powerful deterrent to disclosure.

Not Driving

Suppliers are the stakeholder group most likely not to be driving disclosure. Multiple respondents spoke of suppliers wanting marketing as a result of sustainability initiatives, but many buyer companies are reluctant. Suppliers, on the whole are regarded a group who 'do' the disclosing rather than driving customer companies to disclose. Furthermore, a much bigger group stated that media was not driving disclosure than the group stating media was driving disclosure. This group split into two camps: one, the regulated companies and the second, the companies who feel targeted by the media. This group focused on the negative aspects of media and both groups described the harmful and vindictive nature of traditional media. Social media was evenly split between those who thought it was driving and those who didn't, again, like the NGOs not driving, this split was driven by industry. A much smaller group stated shareholders did not drive but these were mainly in family-owned companies where the family made strategic decisions.

Outcomes of disclosure

Five outcomes of disclosure were stated by 50% of the respondents. This is interesting as only 30% of interviewees are in companies that are disclosing supply chain information. The most common advantages stated are: trust and loyalty of customers or consumers, competitive advantage, supply chain advantage (where visibility in the supply chain confers multiple benefits) and a related risk mitigation advantage, as disclosure can act as an 'early-warning system' for issues in the supply chain. When the company discloses, it gains a reputational advantage. It is regarded as forward-thinking and innovative with greater insight into the opportunities and problems across its operations and supply chains. Ethical advantage, is quite different. This is where other companies, NGOs, customers, consumers and talent know they are working with or for a company that is meeting or exceeding societal expectations. This is

also linked with actual impact, where supply chain disclosure is leading to initiatives in the supply chain that positively impact the planet or the people in the supply chain.

The outcomes are tightly overlapped and interconnected. Interviewees see advantages as virtuous circles where insight into supply chains brings multiple benefits. These include marketing advantage, where companies can use storytelling and differentiation to increase attractiveness and differentiation leading to increased sales revenue.

Discussion

This initial grouping and modelling of the constructs from the 16 cases has thrown light on some very interesting dynamics in the supply chain information disclosure process.

The most prominent driver of supply chain disclosure, the same as the sustainability literatures is internal: senior management and corporate culture (Fraj Andres et al., 2009; Pagell and Wu, 2009) and also employees.

Similar to the sustainability literature on institutional theory (Zhu and Sarkis, 2007; Zhu, Sarkis and Lai, 2008), but which has not, to our knowledge been used in the supply chain disclosure field, we find coercive, mimetic and normative drivers of supply chain information disclosure: regulatory, shareholder and business customers; competitors; and NGOs with influence from media, social media and consumers, who appear to coercively or normatively increase pressure on disclosure through concerted action (MacMillan et al., 2004; Deegan and Islam, 2014). In the supply chain disclosure field much more attention is paid to stakeholder theory (Doorey, 2011; Wilson, 2013; Egels-Zandén et al., 2015; Mol, 2015; Van Der Ploeg and Vanclay, 2013), so combining these theories may give additional insight.

In this research, we have also uncovered some new constructs including different types of culture that hinder or motivate disclosure: pioneer, open, regulatory-response, introvert, paranoid and results-driven cultures, some of which have not been previously identified or linked with supply chain information disclosure.

The outcomes are very much in line with the current literature on both corporate responsibility reporting and supply chain information disclosure. Outcomes such as competitive, reputation and brand advantage (Chen and Slotnick, 2015; Doorey, 2011; Egels-Zandén et al., 2015; MacMillan et al., 2004; Waddock et al., 2002; Van Der Ploeg and Vanclay, 2013); and supply chain advantage (Egels-Zandén et al., 2015; Mol, 2015) are described by supply chain disclosure researchers.

However, this is the first large scale case study research to provide evidence across multiple industries. We provide a robust view of the interlinkages between the diverse types of advantage, with reputation and supply chain advantage interdependent with competitive advantage. Ethical advantage is linked more with reputation advantage and impact. Importantly, sustainability improvements through disclosure are discussed in the supply chain disclosure literature but only to say that there is no link between disclosure and sustainability improvements (Doorey, 2011; Egels-Zandén et al., 2015; Mol, 2015). So, this research is the first to make the link between disclosure and impact with multiple respondents describing how their disclosure initiatives have made a qualitative difference to environmental or social issues.

Furthermore, trust and loyalty of customers and consumers (Waddock et al., 2002; MacMillan et al., 2004) appears to underpin all the other advantages and is the most cited outcome. This is surprising as our focus is on the supply chain, so one assumption is that the supply chain will not only be at the forefront of interviewees minds but will also be most impacted by disclosure of its information (Egels-Zandén et al., 2015; Mol, 2015). One outcome we did not find was that disclosure legitimises company behavior and shifts the risk and blame for issues in the supply chain onto the suppliers (Egels-Zandén et al., 2015; Mol, 2015). However, legitimacy may be linked to multiple outcome constructs including ethical, reputation and trust and needs to be explored further.

Our constructs also differ on ethical advantage and risk mitigation advantage. Ethical advantage is the idea that the company is behaving well and is meeting or exceeding societal expectations, which many respondents link to the long-term survivability of the firm. Risk mitigation advantage works as an early-warning system for the company to let decision-makers know if there are issues in the supply chain about quality, process, product, environmental, working conditions or human rights issues.

The outcomes of disclosure are clear and although the interviewees were given opportunity to discuss negative outcomes from disclosing these were rarely mentioned but include audit fatigue, the high expectations when you start to disclose and the risk of other companies 'free-riding' on your initiatives. Although these is not depicted in the model, due to few respondents mentioning them, it is interesting to note that not all outcomes were positive.

Other interesting barrier constructs that are new to the field include the dangerous nature of disclosure, NGOs being difficult to work with and media only looking for bad news, which all appear to either stop or discourage disclosure.

In terms of practical and policy implications, the internal drive for disclosure and the parallel link to sustainability is something that managers and policy makers can be creative in harnessing. Through incentivising pioneer and open cultures in companies through awards, recognition and other intrinsic motivations for senior managers and employees in companies that are pioneering disclosure initiatives or who have excelled despite obstacles in disclosure can create foundations for stories and legends to bring lasting change in companies. One of the main goals of disclosure is informed choice for investors, consumers, customers and society and with parallel external motivation from role model competitors, regulators, shareholders, business customers and NGOs, companies will understand that supply chain information release will become a hygiene factor in many industries. If companies want to have the advantages of supply chain information disclosure they need to overcome introvert and paranoid cultures, and an overly narrow definition of IP and 'results'.

There are some strange results in the research, for instance, NGOs, employees, and shareholders are both described as driving disclosure and not driving disclosure. An initial within case analysis shows that there are industry and company reasons behind these differences and will be the subject of further investigation.

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Naughty but nice: Communications in controversial industries

Donna Marshall
N119 Michael Smurfit Graduate School of Business
University College Dublin
Carysfort Road
Blackrock
County Dublin
Ireland
Telephone: +353 1 716 8008
Email: donna.marshall@ucd.ie

Jakob Rehme
Industrial Economics
Linköping University
SE 581 83 Linköping (Sweden)
Tel: +46 13 28 4447
e-mail: jakob.rehme@liu.se

Stephen Kelly
Business School
Edge Hill University
St. Helens Road, Ormskirk, Lancashire, L39 4QP
Tel: +44 (0)1695 654338
Email: stephen.kelly@edgehill.ac.uk

Daniel Chicksand
Birmingham Business School
University of Birmingham
Edgbaston, Birmingham, B15 2TT
Tel: +44 0121 48886
Email: d.chicksand@bham.ac.uk

Dev Kumar Boojihawon
Birmingham Business school
University of Birmingham
Edgbaston, Birmingham, B15 2TT
Tel: +44 0121 48886
Email: d.k.boojihawon@bham.ac.uk

Naughty but nice: Communications in controversial industries

Abstract

The premise of this paper is that buying companies have to make themselves attractive (buyer attractiveness) in order to attract high-quality suppliers in the industry. We investigate the corporate communications of the largest companies in a unique context: controversial industries. We explore 24 cases in six different industries in order to understand if they discuss the main controversial issues in their industries and, if they discuss these issues, what do they say. We discuss the potential impact of these communications on supplier attraction and business model sustainability.

Keywords: supplier attraction, reporting, disclosure

Paper Type: Working Paper

Introduction

This paper explores how companies in controversial industries make themselves attractive to a potential supplier market. This is particularly important within these industrial contexts, as it may be more difficult to attract suppliers and then to keep them satisfied to maintain competitive advantage (Ellis et al., 2012). As buying organisations become increasingly reliant on their supply chain partners, greater levels of resources are engaged to ensure attraction and supplier satisfaction.

Unfortunately, in the purchasing field, the research on the task of attracting suppliers is almost completely neglected unlike that of attracting buyers, which dominates marketing. The prevailing attitude that the customer is key to the transaction, while the supplier has to do all the work means that researchers have neglected the methods and impact of attracting high-quality suppliers. A key factor across this body of work is the identification of whether the customer has a good reputation for trustworthiness and fairness (Pulles et al., 2016) and can be intrinsically trusted (Ellegaard & Ritter, 2007; Hald et al., 2009). By looking specifically at how organisations within controversial industries portray themselves and communicate their controversial issues, this paper contributes to the development of the supplier attraction field by building on work which determines the components that make up the supplier attraction concept and the specific factors that generate attraction.

Once a relationship has been established between a buyer and supplier, ongoing efforts are needed to ensure that satisfaction levels remain high. Again, the marketing literature focuses on buyer satisfaction, in this case, consumers (e.g. Lam et al. 2004; Luo et al. 2010; Perkins, 1993). Consumer satisfaction leads to better supplier performance, as consumer satisfaction leads not only to loyalty but also the competitive advantage from that loyalty in terms of increased revenues and profitability (Hallowell 1996; Lam et al. 2004, Luo et al. 2010). This link is so prevalent in the marketing literature that satisfaction is used as a proxy for performance (Hallowell 1996; Luo et al. 2010). Although, supplier satisfaction in the purchasing literature is not as developed, a number of antecedents of supplier satisfaction are identified, with much of the focus on the role of trust (Nyaga et al., 2010).

Communication with suppliers comes in many forms. One of the most visible and easily accessible forms of communication, especially if a supplier has no experience with a buyer is through corporate communication: websites and publically-available reports. However, currently the corporate communication landscape is heterogeneous with different

communication methods used including integrated reporting, stand-alone sustainability reports, downloadable pdfs and non-downloadable webpages. What is reported is also varied with little standardisation, order or context (Kozlowski et al., 2015; Okongwu et al., 2013; Van Der Ploeg and Vanclay, 2013). Some companies offer very little information on any aspect of their operations and supply chains, while others provide a large volume of information. This can be either negative reporting where companies discuss lessons learned and goals for the future, aimed at an audience of legitimising stakeholder groups or positive reporting of performance and goals for commercial purposes (Marshall et al., 2016).

This study will examine the corporate communication of firms in controversial industries, which are defined as industries excluded from responsible investor lists, that are morally questionable and that negatively impact the environment and/or society. We propose that buyers in these industries are not as attractive as buyers in other industries and make up for this by developing robust communications strategies for demonstrating trustworthiness to attract and satisfy suppliers. This leads us to our research questions:

RQ1: How do companies in controversial industries communicate the controversial issues in their industry?

RQ2: How do companies in controversial industries portray their suppliers?

By highlighting the practices of a number of companies within controversial industries, we want to show managers how they can use communications to effectively attract and satisfy suppliers.

Literature review

Supplier attraction and supplier satisfaction

Supplier attraction refers to a supplier's positive response to a buyer's perceived characteristics and behaviour. "Attractiveness is judged by knowledge of the alternatives and by the eye of the beholder, and the expected value ...in which each individual evaluates the rewards and costs gained through interaction with others…" (Mortensen and Freytag, 2010, p. 6). We use the terms 'supplier attraction' to refer to this affective state and its effects on the behaviour of suppliers.

Supplier attraction begins before a buyer-supplier relationship takes place and focuses on the buyer's attempt to engage the services of the supplier. The buyer displays their attractiveness by demonstrating how a supplier can maximise benefits and minimise costs by establishing a relationship with the buyer. Attraction will also be determined by how the supplier perceives anticipated satisfaction from the buyer's competitors and how well they demonstrate relationship benefits and costs (Ramsay, 1994). Extant literature identifies a series of antecedents of supplier attraction. Huttinger et al. (2012) for example, identify key drivers of attraction including risk, technological development, market growth, revenue generation and positive social aspects (2012).

Supplier attraction comes from a combination of costs and benefits and is subject to the effects of comparison with the supplier's prior expectations and expectations of competitor offerings. Therefore, if a supplier values the offerings displayed by the buyer the more likely they are to work with them. Therefore, the better the quality of the buyer's purchase offering, the more attraction the supplier will perceive. Although there are conceptual similarities between supplier attraction and supplier satisfaction, such as the role of trust, satisfaction is experienced after the exchange and all costs and benefits have been experienced. When it comes to prospective buyer's supplier attraction refers to the satisfaction the supplier anticipates

experiencing from working with the buyer. Therefore, it is of particular importance for organisations to portray themselves in a positive, trustworthy manner both before and after the exchange begins. In a similar way to the antecedents of supplier attraction, the anticipation of satisfaction derives from the reputation the company, experienced through the brand, image and communications of the company (Chicksand & Rehme, 2018) and its ability to engender trust (e.g. Nyaga et al., 2010).

While marketing has focused on the attempt to influence the behavioural intentions of consumers our focus is to understand how to influence the behavioural intentions of suppliers in order to enhance supplier attraction and supplier satisfaction. Doing this could lead to minimising external resource costs and maximise profitability, but perhaps, more importantly, could lead to the buyer being a preferred customer for the supplier (Huttinger et al., 2010) leading to preferential resource allocation (Pulles et al., 2016). This can include access to the supplier's proprietary technologies (Ellis et al., 2012), access to better pricing and/or greater levels of flexibility (Nollet et al., 2012).

If a company is in a controversial industry, they have the added problem of dealing with issues that are regarded as undermining the basic societal contract and need to be much better at communicating relationship benefits and attracting suppliers. We want to understand if other companies can learn from the practices of controversial companies regarding how they confront the issues they are faced with and how they communicate these issues to demonstrate they are legitimate and worthwhile companies for suppliers to work with.

Methods

To answer the research questions, we use a case-based approach, drawing on secondary data. The choice of using secondary data was logical as it is invaluable for operations and supply chain management research (Boyer and Swink, 2008) and because of the sensitive nature of the study, which makes primary data collection difficult. The rationale for selecting organisations deemed as controversial, is that need to work harder to demonstrate that they can be trusted in order to attract prospective suppliers and to maintain supplier satisfaction. We make use of Yin's (1994) extreme case study method in order to obtain multiple perspectives via multiple cases of different organisations in a variety of industries.

We based the selection of cases on several criteria: companies had to be in industries that were judged as disapproved on responsible investor lists Triodos Bank (2013) and Domini Responsible Investor list of excluded industries (2017). These controversial industries were agricultural chemicals, alcohol, armaments, coal mining, oil & gas and tobacco. In order to identify the most valuable companies, and the most likely to communicate publically (EY, 2014), we used the Forbes 2000 list (2017) of most valued companies. Finally, the company had to have either over 30% of revenues derived from the controversial activity or be regarded as the market leader in the activity.

We identified the controversial issues in each industry using the descriptions in the Domini Responsible Investor list (2017). The primary issue for each industry and the secondary issues for each industry are given in Table 1 below.

Table 1 - Controversial Issues

Controversial Issues	Primary	Secondary
Agricultural Chemicals	Impact of chemicals on individual health, soil health and biodiversity (harmful and addictive products DRI)	Working conditions and human rights, including conflict minerals
Alcohol	Impact of alcohol on individual health (harmful and addictive products DRI)	Drink driving; working conditions and human rights, including vulnerability of developing world farmers
Armaments	Death, arming risky groups (harmful and addictive products DRI)	Working conditions and human rights, including conflict minerals and arming conflict groups
Coal	Impact of oil and gas on environment including pollution and climate (fossil fuel owners and producers DRI)	Working conditions and human rights, including health and safety of miners
Oil & Gas	Impact of burning oil and gas on environment including pollution and climate (fossil fuel owners and producers DRI)	Working conditions and human rights, impact of oil spills
Tobacco	Impact on tobacco individual health (harmful and addictive products DRI)	Working conditions and human rights, including green lung disease

DRI: Domini Responsible Investor category

Report analysis

We systematically downloaded and analysed the web communication, annual reporting and sustainability report of 24 companies using the factors presented in Table 2. An excel spreadsheet was used to capture the researchers' analysis. The key areas for data collection were organised under the headings 'Controversial Issue Reporting', 'Supplier Reporting', and 'Reporting Strategy' and were chosen in order to help answer the research question:

RQ1: How do companies in controversial industries communicate the controversial issues in their industry?

RQ2: How do companies in controversial industries portray their suppliers?

Findings

The details of the case findings are not presented in this paper, rather a summary of the key findings is given in Table 2 below. This summary lists the key factors and a high-level analysis of how each case company dealt with the factors and this enabled us to perform a within case for each company and cross-case analysis for each industry and across the industries.

Table 2 - Case Findings

	Agricultural Chemicals				Alcohol				Armaments			
	Monsanto	**Syngenta**	**Agrium**	**Yara International**	**Anheuser-Busch InBev**	**Diageo**	**Heineken**	**Pernod Ricard**	**Lockheed Martin**	**General Dynamics**	**Northrup Gruman**	**Raytheon**
Controverial												
Main Controverial Issue	Chemical impact on health and environment	Chemical impact on health and environment	Chemical impact on health and environment	Chemical impact on health and environment	Alcohol abuse	Alcohol abuse	Alcohol abuse	Alcohol abuse	Death, Arming high-risk groups	Death, Arming high-risk groups	Death, Arming high-risk groups	Death, Arming high-risk groups
Report Focuses on Controversial Issue	No	No	No	No	Yes	Yes	Yes	Yes	Partially	Partially	No	Partially
Strategies for Tackling Controversial Issue	None	Addressing complaints in the annual review	Focus on sustainable agriculture but not health	Research and success stories but not on health or environmental impact	Alcohol abuse and road safety programmes	Alcohol abuse and road safety programmes	Media and advertising advocating responsible consumption	Media and advertising advocating responsible consumption	Veterans initiatives, hospital provision	Veterans initiatives, hospital provision	No	Veterans initiatives, hospital provision
Other Controversial Issues	Treating smallholders badly, conflict materials	Treating smallholders badly, conflict materials	Health, Safety and Security	Health and safety, food and resource scarcity	Livelihoods, child labour, environmental impacts	Livelihoods, child labour, environmental impacts	Livelihoods, environmental impacts	Environmental impacts	Conflict materials	Conflict materials	Conflict materials	Environmental impacts, social inclusion
Main Controversial Issue Reporting	Avoid the issue	Avoid the issue	Avoid the issue	Avoid the issue	Admit and provide solutions	Admit and provide solutions	Admit and provide solutions	Admit and provide solutions	Avoid the issue	Avoid the issue	Avoid the issue	Avoid the issue
Supplier												
Focus on Suppliers	Short sections	Short sections	Main focus	Main focus	Main focus	Main focus	Short sections	Very limited	Short sections	Short sections	Main focus	Main focus
Type of Supplier Reported	Raw materials and farmers	Farmers	Farmers	Wide range	Farmers	Farmers	Farmers, distribution	Farmers, distribution	Diverse small suppliers	Diverse small suppliers	Diverse small suppliers	Diverse small suppliers
Supplier Reporting Strategy	Conflict material supplier focus	Conflict material supplier focus	Farmer focus	Focus on suppliers as 'recognised business partners'	Farmer focus	Farmer focus	Move towards local sourcing	Farmer focus	Small suppliers and veteran-owned businesses	Small suppliers and veteran-owned businesses	Diversity and technical capability	Diversity and veteran-owned suppliers
Reporting Strategy	Marketing, descriptive	Marketing, descriptive, addressing complaints	Marketing, descriptive, some research evidence and success stories	Marketing, descriptive, some research evidence and success stories	Marketing, descriptive, success stories	Scientific, descriptive, success stories, GRI focused, data	Scientific, descriptive, focused additional documents available	Marketing, descriptive, success stories	Descriptive	Descriptive	Descriptive	Descriptive

	Coal Mining				Oil & Gas				Tobacco			
	China Shenhua	**India Coal**	**BHP**	**Glencore**	**Exxon Mobil**	**PetroChina**	**Royal Dutch Shell**	**Total**	**British American**	**Philip Morris International**	**Imperial Brands**	**Japan Tobacco**
Controverial												
Main Controversial Issue	Climate change	Climate change	Climate change	Climate change	Climate change	Climate change	Climate change	Climate change	Smoking's impact on health	Smoking's impact on health	Smoking's impact on health	Smoking's impact on health
Main Focus	No	No	Partially	Partially	Partially	Partially	Yes	Partially	Yes	Yes	Partially	Yes
Strategies for Tackling Controversial Issue	Washing coal, green mining, operational eco-initiatives	Washing coal	Operational eco-initiatives, transparent reporting but not product initiatives	Operational eco-initiatives but not product initiatives	Transparent reporting, research collaboration with stakeholders	Transparent reporting and research	Transparent reporting and research	Transparent reporting and research	New non-combustible products	New non-combustible products	New non-combustible products	New non-combustible products
Other Controversial Issues	Safety	Safety	Safety and effect on indigenous people	Safety	Health and safety	Health and safety	Health and safety, social instability, security risks	Health and safety, local environment	Child labour, climate change, livelihoods	Child labour, climate change, livelihoods	Illicit trade in tobacco, tobacco litigation	Illicit trade in tobacco, environmental damage
Main Controversial Issue	Avoid the issue	Admit but no solution	Admit and provide solution	Admit and provide solution	Admit but no solution	Admit but no solution	Admit but no solution	Admit but no solution	Admit and provide solution	Admit and provide solution	Admit and provide solution	Admit and provide solution
Supplier												
Focus on Suppliers	No	No	Very limited	Very limited	Short sections	Short sections	Short sections	Short sections	Main focus	Main focus	Short sections	Short sections
Type of Supplier	Suppliers	Contractors	No specific details	No specific details	Wide range	Wide range	Wide range	Wide range	Farmers	Farmers	Farmers	Farmers
Supplier Reporting Strategy	No focus	No focus	Small, local supplier focus	Child labour focus	Small supplier focus	Small supplier focus	Small, local supplier focus	General description	Farmer focus	Farmer focus	Child labour focus	Child labour and environmental focus
Reporting Strategy	Unprofessional, descriptive	Unprofessional, descriptive	Scientific, case studies	Scientific, descriptive, focused additional documents available	Descriptive	Descriptive	Descriptive	Descriptive	Marketing, descriptive, success stories	Scientific, descriptive, success stories, GRI focused, data	Scientific	Scientific, case studies

Discussion and Conclusions

We identified three strategies companies adopt when communicating their main controversial issue: directly, indirectly and avoid. For alcohol and tobacco companies, it is almost a necessity to *directly* address health issues since these issues are well known in the public domain. We would also expect to find this in industries where impacts are also common knowledge and in the public discourse.

The coal and oil & gas companies in our sample *indirectly* refer to global warming and admit to their role in climate change but only at an operational level rather than a product level. For example, the main focus is the operational ways they reduce CO2 emission, however, they do not tackle the issue of the burning of their product and the harm it does to the environment. Although the coal companies state other renewable fuel sources they are investing in. The main focus of their communication, however, is other operational issues such as health and safety of workers and disaster impact reports. According to Mol (2015), this could lead to loss of legitimacy for these companies and eventually their licence to operate.

Agricultural chemical and armament companies tend to *avoid* their main controversial issues and provide solutions to other issues in their companies, which are not regarded as the dominant societal issue.

Companies within our sample have the added pressure of scrutiny by a number of stakeholders including the media, NGOs, academics and unions. The media and NGOs, in particular, and resourced and well equipped to develop creatively destructive campaigns and boycotts and bring to light poor practices (Deegan and Islam, 2014). Therefore, since they are in the public eye, these companies have to show how they are mitigating their impacts on society as poor practice will be made public, leading to reputational damage (MacMillan et al., 2004; Waddock et al., 2002). It is interesting to note that the companies who tackle their controversial issue head on have also developed solutions to these issues and have created substitute products. For companies who do not address these issues directly there are no readily available substitute products.

Certain companies have turned controversy into opportunity, not least by defusing the controversy by describing the efforts and measures they are taking to solve the controversial issue. This is evident for the alcohol and tobacco companies, who claim to have solutions to their controversy impact. They directly admit the impact they have on society and provide descriptions of products or initiatives that they claim alleviate these impacts. For alcohol companies, non-alcoholic beverages are an obvious solution to their controversial issue, whereas the tobacco companies claim that e-cigarettes are a solution to theirs. Therefore, substitute products can be promoted to customers and stakeholders, replacing the harmful ones.

Arguably it appears as though tobacco companies devote less coverage than alcohol companies to their controversial issue and it is less prominently displayed in their reports. The focus of their argument is that consumers should be given choice and that this needs to be balanced against conclusive scientific evidence of the health risks. However, their solutions are centred around the development of new products, and thus offer a wider choice to their customer. From these findings our first proposition is:

Proposition 1: Companies will focus on controversial issues if they can market a substitute product as part of the solution to the issue

It appears when there is little scope for substitute products, and where the companies are not willing to advocate less consumption, they *avoid* their main controversial issue, instead they will emphasise dealing with them indirectly through their operations. For instance, companies in armaments are not seen to be tackling issues pertaining to 'death and injury to

people' but they invest in technologies, infrastructures, products and services which posit them as leading or cutting-edge innovators in their industry, thereby seemingly contributing to the wider welfare of society. Therefore, our second proposition is:

Proposition 2: Companies will avoid a dominant controversial issue if it is part of their core business (if they have no substitute product) and will give prominence to another controversial issue

It is evident that in controversial industries we cannot argue that all firms have developed robust communications strategies for attracting suppliers. A focus on supplier attraction i.e. the proactive management of the satisfaction the supplier anticipates experiencing from the act of exchange through communication and reporting, was more developed in companies located in the US or Europe and that were listed on US or European stock exchanges. In contrast, professional report was not as developed in the semi-state or developing world reports. India Coal, China Shenhua Energy and PetroChina, appear to be at the early stages of reporting. We, therefore, conclude that sophisticated sustainability communication and reporting is essential for companies in the developed world, which can lead to the attraction of suppliers:

Proposition 3: Reporting and communication is essential for controversial companies in the developed world to maintain their social contract and attract suppliers.

Proposition 4: Controversial companies, with previous semi-state ownership, from developing countries, will have less focus on reporting to maintain their social contract and attract suppliers.

It appears that companies in controversial industries understand their dependence on suppliers to their core businesses or capabilities and have focused on different suppliers depending on their industry context. This dependence is a potential risk or vulnerability to them. Companies in agricultural chemicals, armaments and oil & gas appear to manage this vulnerability by working with numerous, small-scale, diverse and a financially-weaker pool of suppliers who are selected and scrutinised by their in-house supplier codes of conduct. These codes of conduct whilst guiding supplier selection can also be perceived as straitjackets that can undermine the smaller supplier's operational autonomy over the long term. It can also be a tool to steer suppliers to depend on the larger buying company instead. Our review of these guidelines suggest that these 'codes of conduct' are so elaborated, sophisticated and scrutinised that once a supplier has gone through the selection process, it is locked in to a long-term service agreement with the controversial buyer. Companies in controversial industries appear to align their supplier codes of conduct to their perceived controversial issue. However, this alignment becomes less significant over time as the relationship deepens and the suppliers become more dependent on the controversial buyer.

Proposition 5: Buyer companies in controversial industries will align controversial issues to their own codes of conduct to create, maintain and sustain their attractiveness.

In conclusion, buying companies in controversial industries can be delineated quite clearly by the industry they are situated. Alcohol and tobacco companies appear to have found a sustainable model for supplier attraction and business survival. The other companies in the sample would do well to understand the strategies of these two industries to be attractive to suppliers and avoid an unsustainable business model.

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SUPPLY MARKET DEVELOPMENT AT A PUBLIC AGENCY

Mika Matela[1], Tiina Jauhiainen[2], Joni Mäkinen[3] and Jukka Hallikas[4]*

[1] Finnish Transport Agency, Finland, matela@iki.fi, *corresponding author
[2] Finnish Transport Agency, Finland, tiina.jauhiainen@fta.fi
[3] Finnish Transport Agency, Finland, joni.makinen@fta.fi
[4] Lappeenranta University of Technology, Finland, hallikas@lut.fi

Abstract

This research identifies potential solutions for supply market analysis and improvement in purchasing category management. Supply market development contains several practices that have effect on purchasing effectiveness. The empirical research is based on two expert focus group surveys, interviews and two workshops, which were executed in the Finnish Transport Agency. The preliminary results show that development areas of *purchasing planning instructions*, *market dialogs and networking with suppliers and buyers* were estimated to have the most supply market development potential in the case agency.

Keywords: Supply market development, Purchasing development, Public procurement

Submission category: Working paper

Introduction

Supply market development and analysis is a topical theme in the public sector. The decline in the resources of the public sector has prompted governments to look for new innovative solutions that can produce legislation-defined mandatory services with fewer resources and greater efficiency (Hartley, 2005). The public agencies are trying to avoid supply side monopoly situations via supply market development actions because monopolistic or oligopolistic suppliers often do not have incentives to act efficiently from the buyer point of view (Van Weele, 2005). Supply market development actions can mitigate supply chain risks (Sodhi and Tang, 2012).

In this study, we aim in investigating the most valuable development actions for supply market development. We-illustrate how the organization may find and prioritize potentially efficient and effective supply market development actions in their purchasing categories. The identified supply market development actions are especially suitable for organizations which utilize purchasing category management model that has purchasing categories with only few suppliers. The contribution of this paper is to provide impact and feasibility estimations of different supply market development actions which were recognised by purchasing category (PC) managers of the public agency. In the literature, it has been remained mostly unaddressed that which PC activities have the most impact on effective development of supply markets.

Background and literature review

Companies are trying to improve competitive advantage, purchasing performance or purchasing innovativeness with supply market analysis and development. Agencies have similar targets with performance and innovativeness. Nowadays supply market development is taken seriously also in the public sector. Supply market development can be part of the performance aims of the public

organization. In this paper *supply market development* term is used, because in the literature alternative *supplier market development* term is less frequently used.

Supply market development may improve public sector purchasing innovativeness and increase purchasing innovations. Supply market development may lead to improved communication and collaboration between buyer and suppliers. *Early supplier involvement* (ESI) and collaboration have been sources of certain innovations (Wynstra et al., 1999; Schiele, 2010). In the recent years considerable attention has been given to innovation and in the public purchasing management area (e.g., Moore and Hartley, 2008; Pollitt, 2011, Bekkers et al., 2011; Edler and Georghiou, 2007). The EU countries are setting targets for innovative procurement and making efforts to measure innovations made in the governmental organizations (Hughes et al., 2011; Arundel and Huber, 2013; Bloch and Bugge, 2013; European Commission, 2012). It is acknowledged challenge to measure and quantify performance of purchasing innovations (Kattel et al., 2013). Despite of innovation measurement challenges, the results of this study include concrete high impact actions for supply market development in the case agency (Table 2). These supply market development actions of this paper may have positive effect on purchasing innovations and innovativeness. The knowledge of previous supply market development actions (Table 1) may also be utilized by new purchasing categories or even by other organizations. Supply market practices may be considered as *purchasing innovations* (Walker, 2008; O'Toole and Lawrence, 1997) if supply market practices or development actions are considered as new to a unit of adoption and bring new value to the customers of purchasing.

Supply market and other supplier development can be considered as part of Supply Chain Management (SCM), which manages the flows of information, materials, and services from suppliers through production to the end customer. It is said that the SCM aims to reduce uncertainty and risks in the supply chain. From the buyer perspective in the SCM risk mitigation it is important to guarantee that supply markets are working healthily and providing expected services and products on time to their purchasing customers. If supply markets are too narrow and too few suppliers can only provide services or products, then supplier may act in a monopolistic way and cause unwanted cost, availability or quality level changes to its customers. (Leenders et al., 2006).

Supply market development related topics like supplier development (e.g. Handfield et al., 2006; Krause et al., 1997; Krause, 1999; Leenders et al., 2006; Monczka et al., 2002), supply market analysis (SMA) (e.g. Parniangtong, 2016) and supply base development (e.g. Monczka, 1993) have been covered in the earlier research. However, there is a research gap concerning how the supply market analysis results are transforming into supply market development actions especially in public sector purchasing organizations.

Empirical study

The case organization, the Finnish Transport Agency purchases annually with 2100 million euros. Several purchasing categories of the FTA have a high impact especially on the infrastructure supply markets. The FTA is the only purchaser in certain purchasing category areas in the Finland. However, purchases of majority of the categories do not have dominating position in the markets.

In the empirical part of the study, we identify the appropriate development actions to guarantee functioning markets and to improve quality and cost effectiveness of supplier provided products and services in the case organization. The case study covers all 17 purchasing categories of the

FTA. Each PC is composed of one to seven PC products. The PC managers are the focus group in this study.

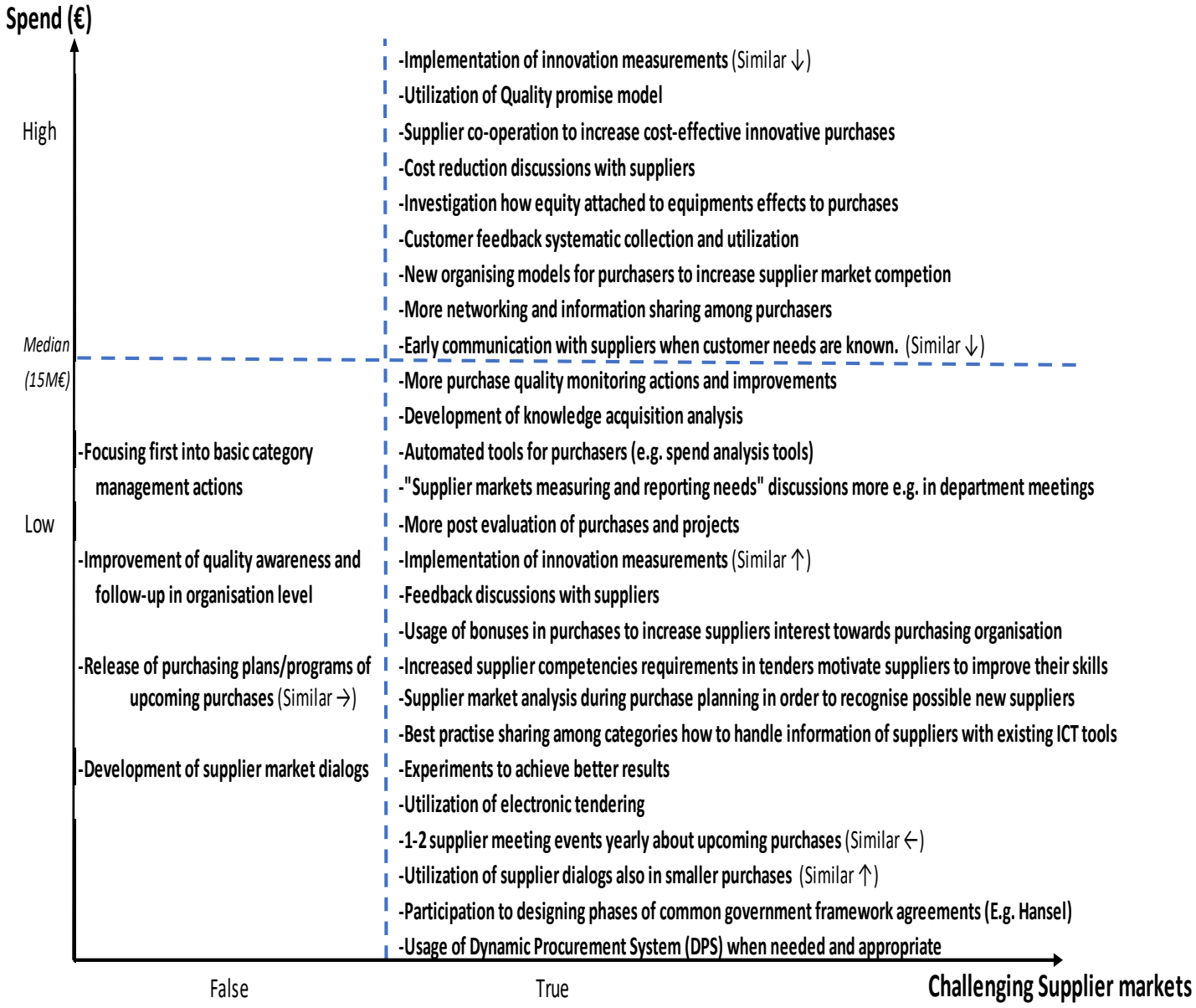
In the first stage of the study, we conducted the survey and asked from the focus group e.g. about the supply market development importance and features in their category. The survey included questions covering also purchasing strategies, purchasing performance, purchasing operations, category continuous improvement and supplier risks. 17 answers were collected from the survey. In the second stage, we carried out semi-structured empirical 16 interviews for each focus group member. One interview covered two PCs because one person was responsible of two categories. The interview themes covered the previously mentioned survey topics. By interviewing it was searched the reasons why certain survey claims were either above or below organization's average in the interviewed category. Interviews provided supply market understanding e.g. about challenges, best practices, supplier/purchaser benchmarking, as well as characteristics of supply markets and beneficial development areas.

The third stage of the study contained two workshops. In the first expert workshop was found nine supply market development areas or actions which had the most impact to categories of the agency according to group of the PC managers. The first workshop was implemented by using semi-structured focus group method. The second workshop with ten attendees prioritized proposed top supply market development actions by valuating impact and feasibility of each action. In the latter workshop we used the structured focus group method. In the second workshop the group of the PC managers were asked to report new supply market development actions if something was missing from earlier identified supply market development proposal list. This list was formed mainly based on focus group interviews and the results of the first workshop. In the next phase of prioritization workshop participants voted the impact and feasibility values of each development action proposal from the agency's point of view. Likert scale (1-5) was used in voting of impact and feasibility values of development actions. (Value 1 meant that action had very low either impact or feasibility from the whole agency point of view. Value 5 meant the opposite, meaning that action had very high impact or feasibility.) At the end of second workshop it was discussed the managerial explanations and the implications of the results. In the workshop the PC Managers were instructed to make supply market development plans from the perspective of their own categories.

Findings and implications

The results of the focus group interviews can be seen from Table 1 which contains experiences of supply market development actions and methods in the different purchasing categories. Y-axis describes the spend of the category which was interviewed. X-axis shows that did the interviewed category manager of development action report to have supply market challenges in his/hers category. Information of X- and Y-axis were gathered from the implemented survey of the category managers.

Table 1. Previous both supply market experiences and development actions based on the focus group interviews.



The ideas of supply market development prioritized in the second workshop are shown in Table 2. The table contains workshop participants' opinions about the supply market development actions from impact and feasibility from agency purchasing categories point of view. Table 2 includes ID information of each development action. Figure 1 shows how development action IDs are positioned in a XY-matrix where X-axis describes impact and Y-axis describes feasibility values of each development action.

Table 2. The second workshop results of the supply market development actions.

ID	Prioritized supply market development actions	Impact	Feasibility
1	Purchasing planning instructions are developed in decentralized categories. Decentralized categories have purchases which are divided to different departments and units in the organization.	★	★
2	Market dialogs are utilized systematically more often and in larger scale.	★	★
4	It is verified that purchasing models and document templates of purchasing products are renewed systematically by utilizing both supplier and purchaser feedback information.	★	★
5	Open purchaser-suppliers meeting days are arranged more often.	★	★
3	Presence in Buyer – Supplier and Buyer – Buyer -collaboration networks are developed in each category.	★	☆
8	Standardized automated tools are developed to support purchasing and supplier monitoring in existing ICT systems.	☆	★
6	More resources for implementation of quality measurement during purchasing contract period.	★	☆
7	Organization decision makers makes sure that purchasing category managers have sufficient resources and support.	★	☆
9	Utilization opportunities of framework agreements are investigated in categories with few suppliers.	☆	☆
12	Peer support networks are created for categories having monopoly or oligopoly supplier situation.	☆	★
14	Survey for suppliers is implemented to get information how interested are suppliers about the agency as a purchaser.	☆	★
10	Purchasing requirements are becoming harder in a long run in purchasing category products (e.g. more value for money, higher quality requirements).	☆	☆
13	Categories with decentralized purchases develop training of their important supplier. Training is about how consults are expected to work in the agency environment and what instructions to follow.	☆	☆
15	Participation to networked competency centre of central government.	☆	☆
16	General and category specific supplier disqualification and dependency	☆	☆
11	Dynamic Purchasing System (DPS) is utilized more often in the selected categories.	☆	☆

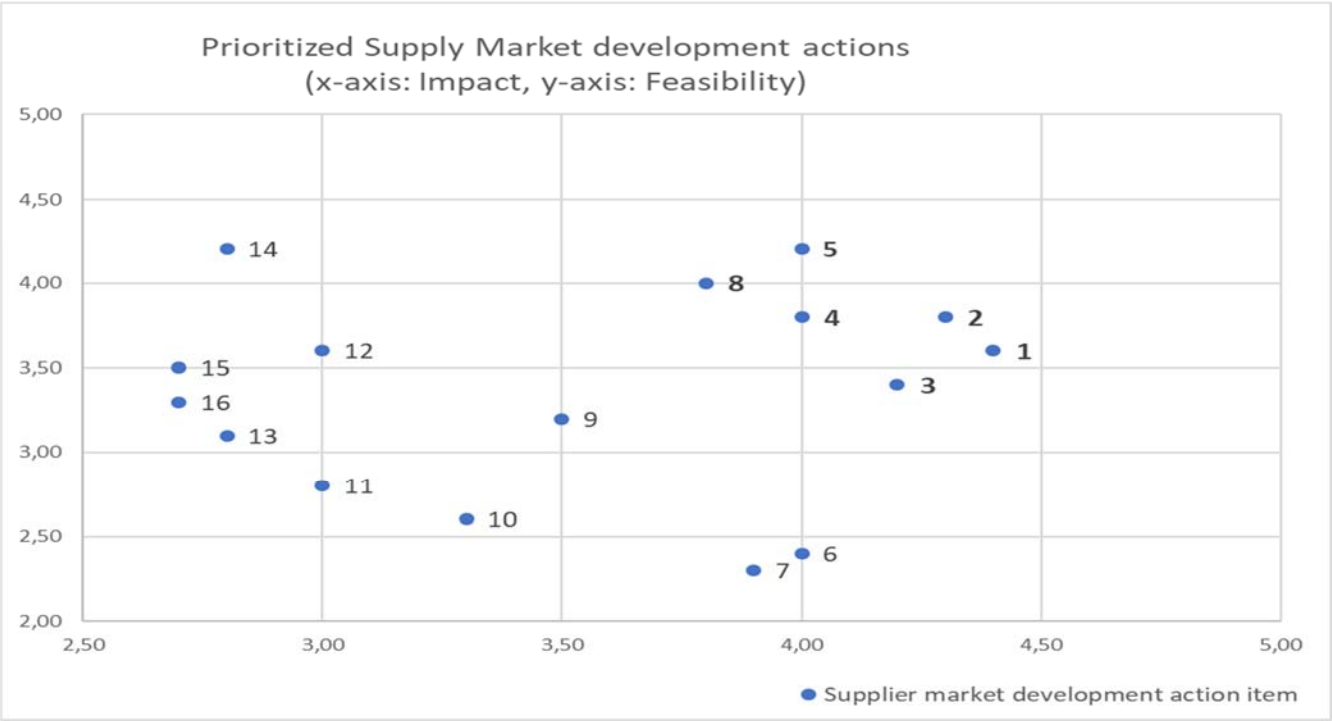


Figure 1. *Impact and feasibility of the supply market development actions in XY-matrix based on the prioritization workshop.*

The main managerial impact of this study is that potential supply market development themes were found. The actions in these themes received high impact and high feasibility scores in the FTA. The main themes were roughly *supplier and buyer communication* (Figure 1 and Table 2: ID2, ID5, ID3, ID12, ID14), *standardization of procedures and tools* (ID1, ID8, ID9) and *continuous improvement* (ID4, ID6).

The action with highest impact score (ID1) was related to purchasing planning instruction creation in decentralized purchasing categories. These purchases of the decentralized categories were implemented in different departments and units of the organization. The buyers of the decentralized PCs can especially benefit about best practises containing purchasing planning instructions because they less often get PC specific instructions or advices from the nearby co-workers.

In the literature standardization of purchasing procedures (like ID1, ID8 and ID9) has been recognized to have positive effect on quality of material, on-time delivery from suppliers, inventory performance and to a business performance (Sánchez-Rodríguez et al., 2006). Purchasing instructions may contain standardized procedures of purchasing planning and supplier-buyer communication. Purchasing planning instructions with supply markets information of the category can be valuable to the new buyers of the PC. Purchasing planning instructions of the PC (ID1) can explain how to implement the most valuable supply market development actions like supplier-buyer communication related market dialogs action (ID2). Market dialogs can be considered a form of ESI.

Continuous improvement related actions were ranked to third position (ID4) and to seventh position (ID6) in impact evaluation. PC managers considered that it is important to verify that purchasing models, procedures and documents are upgraded based on supplier and the buyer information (ID4). Assurance of quality measurement resources during contract period was considered to have high impact but this action was difficult to implement in the case organization because of low feasibility score (ID6). The most feasible development action was ID5 which proposed that supplier-buyer meeting days should be arranged more often.

Conclusions and suggestions for future research

The neglection of supply market development may lead to a situation where number of suppliers is too few and a true competition among suppliers during tendering is missing. Monopolistic or oligopolistic supply markets may raise cost level of purchases and quality of purchases may decrease. This study listed supply market development actions and themes which may also mitigate the risk of monopolistic and unhealthy supply markets. The findings of this study may benefit purchasing category managers and other purchasing professionals who are planning to make effective and efficient supply market improvement actions. In the supply market development planning of PCs it is possible to learn from other categories by using supply market development interviews results (Table 1) and workshop findings (Table 2) of this study. This study found, besides potential high impact supply market development actions (Table 2: e.g. purchasing planning instructions, market dialogs, improvement via supplier and buyer information), potential bottleneck areas (two actions) which can avert the development of supply markets.

One potential future topic for future research is to study the reasons why two topics were estimated to be difficult to implement but still had high impact scores in the case organization (Table 2). Firstly, according to the workshop results the decision makers should guarantee sufficient resources and support to PC managers. In case the PC managers are not allowed to spend sufficient working time for the PC development work and they do have enough management's support, supply market development work may not be as effective as it should. Secondly, another future investigation topic is to think how to guarantee appropriate resources for quality control activities during the contract periods of purchases. We propose that organisation should guarantee that resources of category management and quality measurements are sufficient. Supply market development efforts of PC managers can be inefficient and ineffective without appropriate support of management in the organisation.

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Authors:

Mika Matela *, Finnish Transport Agency, Raatimiehenkatu 23, 53100 Lappeenranta, Finland, mika.matela@iki.fi, +358295343137, * Corresponding author.

Tiina Jauhiainen, Finnish Transport Agency, Raatimiehenkatu 23, 53100 Lappeenranta, Finland, tiina.jauhiainen@fta.fi, +358295343617

Joni Mäkinen, Finnish Transport Agency, Opastinsilta 12 A, 00521 Helsinki, Finland, joni.makinen@fta.fi, +358295343951

Jukka Hallikas, Lappeenranta University of Technology, Skinnarilankatu 34, 53850 Lappeenranta, Finland, hallikas@lut.fi, +358405507499

THE ANTECEDENTS OF PURCHASING INNOVATIONS IN A PUBLIC AGENCY

Mika Matela[1], Janne Posio[2] and Jukka Hallikas[3]*

[1] Finnish Transport Agency, Finland, matela@iki.fi, *corresponding author
[2] Finnish Transport Agency, Finland, janne.posio@fta.fi
[3] Lappeenranta University of Technology, Finland, hallikas@lut.fi

Abstract

The aim of this study is to identify the antecedents of purchasing innovations. This paper introduces a framework for best practices and categorizing the innovations of purchasing. A conceptual model for purchasing innovations was constructed based on a literature review. Empirical study is based on interviews and a survey in a public agency. The empirical analysis of the conceptual model showed that the constructs for sustainable supplier development and purchasing support exert a statistically significant effect on the purchasing innovations. By improving areas of the previous constructs, organizations may improve its innovativeness in purchasing.

Keywords: Public procurement, Purchasing innovations, Finland

Introduction

Public sector innovativeness and innovations are the sources of economic and industrial competitiveness in the European Union (European Commission, 2010). The EU invests 24% of world expenditure on research and the EU dominated earlier global research and innovation field together with the USA and Japan (European Commission, 2012). The western EU countries contributes also circa 20% of GDP to the public sector (Eurostat, 2018). These high contributions mean that public sector innovations can have a high impact to the industrial competitiveness. Similarly, in a high-impact public purchasing organization, such as the Finnish Transport Agency (FTA) (2100 million euros annually) the value potential of purchasing innovations is considerable. The public sector innovations, including purchasing innovations, aim for improved productivity, the efficiency, and the quality of public services. The decline in resources in the public sector has prompted governments to look for new innovative ways to produce and improve agency-provided services (Hartley, 2005). Meanwhile, agencies re-evaluate existing service production processes and attempt to find novel solutions that can produce legislation-defined mandatory services with fewer resources and greater efficiency.

Innovation and innovativeness in the public sector have been widely discussed in the academic literature, but, for the most part, the antecedents of purchasing innovations in public procurement remain undefined and unaddressed (Bekkers et al., 2011; Uyarra and Flanagan, 2010; Hommen and Rolfstam, 2009). This paper attempts to cover a gap in the literature concerning the sources of the purchasing innovations of the public sector. This paper describes a search for the antecedents of purchasing innovations in the FTA. This paper asks the research question of which antecedents explain most of the purchasing innovations in the studied agency. The knowledge about the antecedents and examples of purchasing innovations can be utilized, e.g., when improvements in

purchasing innovativeness and innovations are planned in the different purchasing categories of the FTA.

The first and second chapters of the paper introduce the main terms and concepts of this research study. The second chapter outlines the forms of innovations and innovativeness in the literature. The third chapter depicts the purchasing innovations in the literature and the fourth chapter describes the conducted empirical interviews, the survey, the analyses, and the findings of the survey. The fifth chapter draws conclusions and discusses the managerial implications of the found results. A literature review was conducted to create a conceptual model for purchasing innovations. The empirical interviews of the research focused on the best practices implemented in purchaser-side purchasing and issues related to innovation sources. The interviews gave indications that the created conceptual model for purchasing innovations was suitable for the researched organization. A framework for best practices of this paper is an example how purchasing experiences can be categorized. Interview observations and a created framework of this study may be valuable for category managers of the FTA when actions of purchasing innovation development are planned. In the final phase, the empirical survey featured questions regarding purchasing, purchasing innovations, and supplier innovativeness. The survey results were analysed with an exploratory factor to structure and confirm the conceptual model constructs. The conceptual model was then tested by regression analysis.

Innovation and innovativeness

In the recent years considerable attention has been given to innovation generally and in the public purchasing management area in recent years (e.g., Moore and Hartley, 2008; Pollitt, 2011, Bekkers et al., 2011; Edler and Georghiou, 2007). Like many other popular terms, there is no widely accepted or common definition for "innovation" (Dunleavy et al., 2006). The term is often understood as pointing to originality and effectiveness. Originating from the Latin *novare*, it means renewing or introducing something new (Schiele, 2006). According to Schumpeter (1939), *innovation* can be understood in short as doing things differently in the realm of economic life. Schumpeter (1912) has defined product and process innovations that include the introduction of new products, quality, method of production, or method of handling.

Nowadays, innovating work means creating and implementing a new or significantly improved solution to a meaningful problem (Rogers 1995). In general, innovations do not have to be new to the world, but they should be a novel introduction to the market or industry where such innovations are intended for use (Edquist et al., 2000; Keeley et al., 2013). The studied FTA is a distributed organization that was formed from three agencies in January 2010. According to Schiele (2006), organizational mergers are another source of innovation, along with imitation, the purchase of innovations, the development of new products, and continuous improvement. In the newly merged organization, a single solution may be interpreted as either innovative or standard, depending on the previous experiences of personnel in certain divisions of the organization.

Innovativeness is a major force behind the development of innovation and new products (Droge et al., 2008). Joint product development activities between buyers and sellers may lead to the long-term success and survival of supplier firms. Inemek and Matthyssens (2013) suggested that buyer assistance-giving routines effectively enhance supplier innovativeness in the relationship between an international original equipment manufacturer (OEM) buyer and a first-tier supplier; this enhancement, however, is not as significant with respect to lower-tier supply networks. Improving supplier performance may necessitate that a buying firm invests directly in a supplier's operations

by providing direct assistance through visits, training programs, or assistance from employees in improving the supplier's process efficiency (Krause et al., 2000). Interfirm information-sharing activities constitute imitation, which is considered a source of innovation (Schiele, 2006). An example is Toyota, which as a buyer has provided assistance to its suppliers over a period that is twice as long as that offered by its U.S. competitors (Dyer and Hatch, 2006). This increased buyer assistance to suppliers has resulted, on average, in improved supplier performance in terms of quality and cost (Dyer and Hatch, 2006).

Innovations can be seen as a process wherein new ideas, objects, and practices are created, developed, or reinvented and that are new to a unit of adoption (Walker, 2008; O'Toole and Lawrence, 1997). Public organizations may also innovate in search of legitimacy, thus highlighting the importance of treating innovation as implementation and not merely as an idea (Walker, 2008; Boyne et al., 2004; Damanpour and Evan, 1984). The innovation process includes phases such as understanding, solution idea creation, solution creation and commercialization. Aside from being categorized into processes and services, innovations can also be classified as ancillary (Damanpour, 1987) and inter-organizational (Mandell and Steelman, 2003) types. Process innovations can be divided into technological and management innovations. Walker's (2014) review of the process innovation implemented by governments showed that the internal antecedents of process innovation matter more than their external counterparts.

A further classification of innovations is as incremental and discontinuous types. As explained by Phillips et al. (2006), close supplier relationships favour incremental innovation, whereas new and temporary relationships favour discontinuous innovation. Innovation is important not only in supply chains for physical products but also in processes and services; innovation in both dimensions plays an essential role in innovation management. Innovation may be also affected by organizational factors and characteristics such as industry area, production (manufacturing/service), profitability model (for-profit/not-for-profit), or sector (public/private) (Damanpour, 1991).

Purchasing innovations and innovativeness

In recent years, innovations in the purchasing management field have elicited managerial and academic attention (e.g., Luzzini et al., 2015; Arundel et al., 2015; Schiele, 2006). In various purchasing categories, innovativeness more effectively enables improved performance outcomes than does reducing purchase price. In this paper *purchasing innovations* term is related to practices or actions which are considered as new to a unit of adoption and bring new value to the customers of purchasing (Walker, 2008; O'Toole and Lawrence, 1997). This section briefly outlines the forms and sources of *purchasing innovations*. To identify the nature of purchasing innovations, we reviewed the existing research on this matter.

As discussed previously, the term "innovation" can be seen as broadly defined. Value- and performance-adding innovations may originate from an organization itself because organizational mergers are a source of innovation (Schiele, 2006). *Purchasing innovations* may be also related to supplier innovativeness, which can be enabled by actions and practices of the buyer (Schiele, 2006). Purchasing innovations and innovativeness may be learned from an organization through the best practices that it implements. Best practices are a collection of valuable experiences that may have been accumulated from agencies where employees had previously worked. Valuable purchasing experiences may remain mostly unknown in an organization if best practices are not shared across the possible vertical silos in the organization. The findings of previous studies were

used as bases in developing the conceptual model proposed in the current research study. In the empirical survey chapter of this paper is explained *purchasing innovation* construct meaning in the constructed conceptual model.

The literature review showed that several purchasing and supply innovation sources have practices or solutions that integrate suppliers closely to purchasing organizations (e.g., Wynstra et al. 1999; Schiele, 2010). This integration and supplier innovativeness is often enabled by the changes implemented in a purchasing organization (Schiele, 2006). Lorenzoni and Lipparini (1999) reported that buyers may look for innovation potential among suppliers and try to leverage such potential to create value for their own customers. Innovativeness is also part of the design and implementation of sustainable products and service procurement. Nidumolu et al. (2009) claimed that sustainability is the key driver of innovation. Sustainable procurement takes into account the environmental, social, and economic effects of purchases (Australian Government, 2013). In the healthcare sector, for example, the rationalization of packaging has generated innovations that exert positive environmental and economic effects without compromising product performance (Green et al., 1998). Isaksson et al. (2010) argued that supply chains generally present considerable innovation potential for sustainable development. Green et al. (1998) mentioned that a critical type of power in the buyer–supplier context is a firm's ability to innovate and become a source of new ideas for its partners. Miemczyk et al. (2012) described how sustainable purchasing components, such as ethical behaviour, have been incorporated in the measurement of innovativeness in the literature.

According to Inemek and Matthyssens (2013), purchasing assistance from a buyer may enhance supplier innovativeness in the presence of certain buyer and supplier characteristics. Supply risks are relevant to purchasing because the complexity of purchased services and products is often considerable. The increasing complexity of solutions drives buyers and providers to consider approaches that include risk and benefit sharing. The complexity of purchases is equally relevant to supply chain innovation (Harland et al., 2003).

Calantone et al. (2002) demonstrated that innovativeness is related to firm performance, while Petroni and Panciroli (2002) studied innovation as a determinant of supplier performance. Bringing innovations to the purchase process re-engineering and automation innovations involved in supply chain processes may affect the structure and effectiveness of purchasing (Croom, 2001). As described by McGinnis and Vallopra (1999), the development and improvement of production and operations processes substantially contribute to competitive advantage; in these initiatives, purchasing is likely to play a major role.

Other important sources of purchasing innovations are e-commerce and information and communications technology (ICT) applications in supply chains (Croom, 2001; Min and Galle, 1999; Monczka et al., 2010). Incremental innovation focuses only on the reduction of administrative costs by automating manual processes (Croom, 2001), whereas more sophisticated innovation approaches encompass the use of the Internet to seek new suppliers (Croom, 2001) and the use of e-systems to acquire innovation ideas from suppliers (Monczka et al., 2010). Suppliers can serve as important sources of innovation by bringing in new ideas and concepts and considerably reducing the development time of services and products (Min and Galle, 1999).

Early supplier involvement (ESI) and supplier innovativeness in product and service development emphasize collaboration with suppliers in developing or implementing certain innovations

(Wynstra et al., 1999; Schiele, 2010). ESI seeks to develop collaborative processes for the early involvement of suppliers and supplier innovations. The advantages presented by early involvement include the reduction of the time required for product development cycles, improvements to product quality, enhancements to the use of supplier expertise, improvements to cost management, and reduced supply risks (Zsidisin and Smith, 2005). Supplier base management helps purchasers concentrate on supplier organizations that exhibit a strong potential for innovativeness (Schiele, 2006).

Traditional supply-side innovation policies are insufficient to satisfy the challenges posed by promoting competitiveness and therefore give rise to the need to create an innovation-seeking demand and market. Edler and Georghiou (2007) identified several areas where innovation can be applied, namely, the sectors of transport and logistics, e-health, pharmaceuticals, energy, environment, security, and digital content. The recent trend of sustainability in product development should be taken into account when considering the ability of organizations to use market mechanisms in persuading suppliers to innovate or increase the environmental performance (Green et al., 1998).

Recent research conducted by Monczka et al. (2010) addressed the importance of integrating supply management in the innovation strategy and R&D roadmap of an organization. Schiele (2010) stated that technology roadmaps can be used to bridge new product development strategies and sourcing strategies. Such bridging is achievable by including supply network design as a step in roadmap formulation and involving purchasing professionals in the formulation of the design. Monczka et al. (2010) discussed the importance of carrying out a business analysis of the tradeoff between price and innovation and organizing innovation workshops with key suppliers.

Purchasing innovations may also improve the performance outcomes of public organizations more than focusing on price reduction (Edler and Georghiou, 2007). Innovation in the supply chain involves making changes to products, processes, or services to either reduce cost or improve efficiency and thereby increase customer satisfaction (Bekkers et al., 2011). Innovative public purchases may also create new viable private sector solutions to market issues through either the *public procurement of innovation* (PPI) or *pre-commercial procurement* solutions (PCP) (Edquist and Zabala, 2012; Edquist et al., 2015; Bos, 2016). *Purchasing innovations* are also considered as new by the purchasing personnel (Edquist et al., 2000; Rogers 1995).

The findings of the conducted literature review are summarized in Table 1 which contains literature findings that may explain purchasing innovations in organizations. The literature review indicated that purchasing performance is not regarded as a possible source of purchasing innovations. According to the literature, innovativeness has a positive relationship with performance (Calantone et al., 2002; Petroni and Panciroli, 2002). We presumed that the literature would show that well-performing organizations have resources and practices that increase organizational innovativeness. Table 1 also presents the framework that we developed for the categorization of best practices and purchasing innovations. Table 1 includes hypotheses, which potentially drive purchasing innovations. These hypotheses is used in the following phases of this study.

Table 1. Possible sources of purchasing innovations and the framework for the categorization of best practices and purchasing innovations.

Possible source of purchasing innovations
• H1: Supply risk (Monczka et al., 2010; Harland et al., 2003; Zsidisin and Smith, 2005) • H2: Purchase support (Inemek and Matthyssens, 2013; Krause et al., 2000; Dyer and Hatch, 2006) • H3: Supplier sustainable development (Isaksson et al., 2010; Nidumolu et al., 2009; Green et al., 1998) • H4: Supplier base management (Lorenzoni and Lipparini, 1999; Green et al., 1998; Schiele, 2006; Phillips et al., 2006; Monczka et al., 2010) • H5: Customer need fulfillment (Monczka et al., 2010; Edler and Georghiou, 2007; Lorenzoni and Lipparini, 1999) • Purchasing performance

Based on literature review the initial conceptual model for *purchasing innovations* was created. Figure 1 represents the conceptual model. The model is explained more in the following chapter.

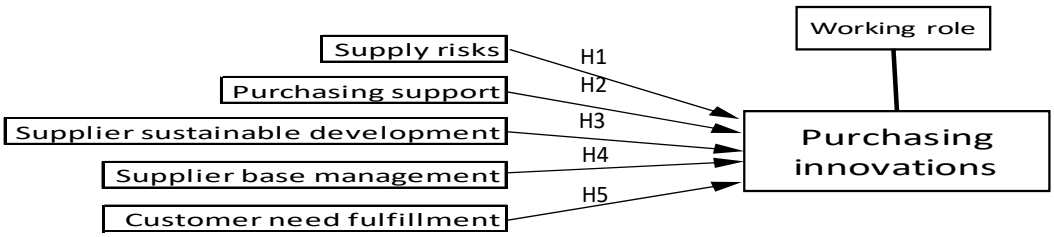


Figure 1. Initial conceptual model for purchasing innovations.

The EU commission and individual countries, including Finland, have plans for government purchasing innovativeness improvement. The Finnish government is aiming that 5% of public sector procurement is innovative. In the same time European countries are making efforts to measure government innovations (Hughes et al., 2011; Arundel and Huber, 2013; Bloch and Bugge, 2013; European Commission, 2011). A challenge for the governments is to measure and quantify performance of purchasing innovations (Kattel et al., 2013). Many countries plan to improve the procurement innovation situation but, in many countries, concrete innovation measurement systems and measurement guidelines do not yet exist (OECD, 2016).

One example about innovation measurement is the Department of State procurement of France (Service des Achats de l'Etat, SAE) which has an innovation indicator in their procurement performance measurement system. This innovation indicator describes a portion of amount of procurement for innovation contracts. Innovation indicator of SAE is reported by the buyer at the time of purchase and no impact or evaluations were done concerning procurement for innovation (OECD, 2016). Currently in Finland the buyer reports in procurement notice that does the used purchasing method consider innovation aspects. It is not self-evident that which criteria buyer uses in evaluation of innovation aspects of his/hers purchase. This paper studies that what are the antecedents of purchasing innovations in the studied organization based on purchasing survey results which was answered by employees in different purchasing roles. These antecedents give information that which topics influences on decision of the buyer when purchasing is considered

as innovative or not. Recently it has been given a proposal about the measurement areas of purchasing innovations, so the antecedents of purchasing innovation topic is contemporary in Finland (Valovirta et al., 2017).

Empirical study

The first phases of the empirical study involved interviews with the employees of the FTA. The empirical interviews were done in order to get confirmation that the literature findings of purchasing innovation sources apply to the studied case organization. Based on the empirical interviews and literature review results, an initial conceptual model for purchasing innovations was created. In the last phase of the study, an organizational survey was administered, and the survey data were analysed against the developed conceptual model.

The motivation for selecting a mixed-method approach to the empirical study included complementary and triangulation purposes in order to accomplish a richer and deeper understanding and a higher validity of the results (Greene et al., 1989). The primary qualitative interviews analyses were supplemented with quantitative data based on the survey data and statistical analysis.

Despite of the ongoing debates of *common method bias* (CMB) (Spector, 2006; Doty and Glick, 1998), the CMB may be a potential problem in the study because empirical interviews and survey results are from a single organization. The empirical survey and interviews results may be influenced by a desire to appear consistent or by a tendency for interviewees/respondents to agree with assumptions (Podsakoff et al., 2003). The CMB problem may be tested with Harman's single-factor test (Harman, 1967). The CMB exists if a single factor will emerge from a factor analysis of all survey items or one general accounting for the common variance existing in the data will emerge. In this research we loaded items into an EFA and examined the unrotated single-factor (Podsakoff et al., 2003). The single-factor explained only 37% (<50%) of the variance in the items. In *principal component analysis* (CFA) tree factors had eigenvalues greater than 1.0. This implies that CMB is not present our research data.

Empirical interviews

The first part of the research study comprised semi-structured empirical interviews. The formulated interview themes revolve around successful purchases, information quality, origin and application with respect to best purchasing practices. A total of 23 people, who are procurers, managers, or staff involved in purchase tasks, were interviewed individually or in groups. The interviewees whose purchases belong to the same category or resemble one another were classified under one group. The interview observations were organized, documented and revised by two authors. During the interviews the organizers noticed that the outputs of group conversations started to resemble previous conversation results. After interviewing 23 persons, the authors decided that additional interviews were not needed it was judged that such would not bring enough new value to the study.

On the basis of the interview results, over 100 items about best purchasing practices, improvement proposals, training proposals, bottlenecks, successful purchasing cases, and other purchasing-related observations in different procurement categories were formulated. In the next phase, affinity diagrams were drawn to find groups that exhibit similarities, as determined from the

documented observation items. The results of a previous interview analysis showed that many of the best practices for purchasing and supply management in the FTA can be classified under the following categories: *purchasing performance*, *supply risks*, *purchase support*, *supplier sustainable development*, *customer needs,* and *supplier base management* (Table 1). This categorization framework may be used for future purchasing development purposes. One of the goals of the interviews was to identify those procurement categories that are the best sources of up-to-date information concerning best purchasing practices. The categorization of the identified purchasing innovation and best practices may reveal, for example, opportunities for joint development between different purchasing categories or organizational entities.

The interviews indicated that a purchasing history database that contains previously implemented best purchasing practices and experiences may improve the FTA's purchasing process. Having a repository of best practices may improve purchase performance and reduce project risks because experiences regarding similar projects are available in the initial phase of the purchase process. Several of the interviewees believe that examples of successful purchases can be instructive to procurers. A given purchase is often characterized by unique project-specific characteristics, but procurers or project managers can use examples as references in applying new practices within a given project context.

The interviews also highlighted the need to consider purchasing risks during the purchasing preparation phase. The benchmarks used by other organizations in the preparation phase may decrease the probability of problem and risk occurrence during purchase implementation.

Innovative solutions are often associated with supplier-side innovations. The interview observations indicated that enabling supply and purchasing innovation necessitates sufficient capability to purchase support resources. The necessary support resource skills may be specific to a project context. The interviewees acknowledged that additional purchasing training programs, such as training on pragmatic contract reviews or professional service procurement processes, may improve quality and shorten the lead times of purchases. Another observation from the results of interviews was that reported purchasing best practices (Table 2) were discussed as purchasing best practices of buyers. However, it is possible that innovative new practices of interviews were originated from the supplier-side.

Table 2. Examples of purchasing best practices and proposals from the interviews.

Best practice category	Example purchasing best practice or proposal from interviews.
Supply risk	- Supply risks should be identified, and risk management activities should be implemented. Risks exist always and purchasing personnel should be able to live with those when appropriate risk management actions have been followed. - Risk management and responsibilities tables should be defined in contract if more complex purchase at hand. - Benchmarking of own agency and other agencies similar purchasing experiences may be valuable in risk mitigation. - Continuous systematic learning from purchases should be applied in order to improve quality and mitigate risks. Purchasing category responsible can share previous purchasing knowledge and experiences e.g. by arranging purchase kick-off meetings for procurers.

Purchase support	- Purchasing support persons of procurement unit collect and share purchasing best practices across the organization. - Purchasing support persons should reserve time for processing of emergent support issues. - Purchasing training needs from different topics like how to purchase professional services easily. - Important to find a person who has implemented similar purchase and have possibility to get sufficient support from him at the right time. - Need for an internal purchasing service which takes care of purchases of certain domain.
Supplier sustainable development	- Projects must plan and implement project hand-overs during a life cycle of the service or the product. Life cycle management can include economical or environmental topics. - Process efficiency improved in projects when onsite processes taken into use. E.g. printing and signing of documents right away after the meeting reduces unnecessary waiting and travelling of people.
Supplier base management	- Important to have supplier network practices in order to hear and collect new value adding proposals from new potential suppliers. - Good communication to suppliers is important. - External organizations have capabilities and knowledge which can provide e.g. innovative financing solutions for tendering. - Good tendering schedule enables to get sufficient number of suppliers to competitions. Healthy competition can increase innovativeness of offers. - Communication and appropriate co-operation with supplier side central organizations can be beneficial.
Customer need fulfillment	- Technical dialogs during purchasing process improves outcome of provider selection process. Customer needs can be described during technical dialogs and providers can propose new solution proposal to purchaser. - Customer requirements and needs should be recognized before start of tendering process. - Psychological tests can be part of supplier selection in order to find motivated persons. - Important to recognise the stakeholders of the project in early phase. Involvement of stakeholders during the project should be guaranteed.
Purchasing performance	- Need for a database containing purchases information: who carried out the last purchase/what good and bad experiences they had and what they learned. Usage of previous purchasing experiences may increase amount of value adding work. - Lessons learned and retrospective meeting at the end of projects may improve learning. Appropriate project documentation may help future projects. - A database of previous purchases can accelerate information searching. - Purchasing experiences are shared via collaboration networks where purchasing personnel shares their knowledge of previously implemented purchases with co-workers.

Many of the interview responses revolve around communication with the stakeholders of a project. An important stakeholder group in both private and public procurement comprises the intended

customers of a project. A customer can be defined and interpreted in different ways, but it normally refers to an entity that receives value from purchase results. In the private sector, the end-customer is often willing to pay for the value received from a service or product. In this study, the construct *customer need fulfillment* was especially highlighted from the perspective of end-customers (Table 3). The interview respondents also stated that improved implementation often translates to the presence and involvement of purchase customers at the beginning of a project, during purchase, and during implementation. Without customer involvement, it is difficult to verify that a supplier solution or delivery has generated the targeted positive value for customers.

Sustainable procurement entails thinking about economic, social, environmental, and ethical aspects over whole-of-life costing, which is also known as life cycle costing or *total cost of ownership* (Australian Government, 2013). The interview results showed that best purchasing practices encompass life cycle thinking. Life cycle observations focus on project improvement practices that concern the minimization of lead time and the reduction of unnecessary work. These are achieved, for example, by quick onsite project meeting practices, such as contract signing. Planned handover periods for information sharing between projects are also encouraged. Previous practices improve professional service results because these avoid, for instance, unnecessary traveling and trial-and-error learning.

Another interesting finding from the interviews is that good and innovative bids require working markets and a sufficient number of capable suppliers. A procurer can make decisions during competition planning, which can affect a number of received bids. One of the observed best practices implemented in the case organization is the year-round scheduling of competitions, which enables more bidders to participate in requests for quotations.

To sum up, the literature review and interviews were aimed at confirming an initial conceptual model for *purchasing innovations*. We found that best purchasing practices of interviews (column 2 of Table 2) can be categorized into similar typologies and categories, as determined from the literature review (Table 1).

Empirical survey

To understand the factors that underlie purchasing innovations, we conducted a web survey in the FTA, from which 115 answers were received. Table 3 shows Likert propositions of the survey and the seven areas targeted by the survey measurement. The survey measurement areas were developed with factor analysis. Table 3 lists the related constructs identified in an exploratory factor analysis (EFA). The *purchasing innovations* construct in Table 3 signifies the enabling of supplier innovativeness either through methods and processes or assistance from suitable contractual agreements and proposal requests.

Table 3. The constructs and their measures in the survey (1-7) Likert scale.

Model constructs measures and their measures	Cronbach alpha	Mean
Purchasing innovations	0.6	
Supplier innovativeness is enabled by the methods and processes utilized in the purchasing category.		3.9
Contractual agreements enable innovative solutions from suppliers		3.8
Request for proposals allow suppliers to offer innovative solutions		3.6

Customer need fulfillment	0.6	
Customer needs are considered in the planning of purchases		5.4
Changing end-customer needs are considered during the contracting period		4.8
End-customer satisfaction for need fulfillment is assured after the purchase		4.6
Supply risks	0.7	
Delivery risks		4.4
Quality risks		4.6
Cost and price risks		4.3
Environmental hazard risks		2.7
Risks related to supplier unethical behaviour		2.5
Legal risks		3.6
Risks associated to supplier financial problems		3.1
Purchasing support	0.6	
Juridical support resources are available for purchases		4.9
Support resources are available for purchases		3.6
Supplier sustainable development	0.6	
Supplier information is collected systematically inside the purchasing category		3.2
Suppliers are developed based on evaluations		3.4
Supplier sustainability is considered in all purchases		5.5
Social and economic sustainability targets are considered for purchases		3.9
Green sustainability targets are considered for purchases		4.3
Supplier base management	0.6	
Knowledge in the purchasing category about the most important suppliers		5.7
The number of suppliers in the category is sufficient for maintaining competition		4.5

In the survey, responders estimated given survey arguments with a 1-7 scale (Table 3). In the supply risk area questions, the highest value 7 meant that the risk of a given argument was considered as high. The value 1 was given to the risk arguments when the risk of argument was low. In the other survey measurement areas, the value 7 meant that a survey argument reflected very well, and the lowest value 1 meant that a given argument reflected very poorly, the reality according to the responder. Each survey respondent categorized himself/herself under one or more *working role* groups, namely, *full-time purchasers*, *part-time purchasers*, *decision makers,* and *other* individuals involved in the purchase process. A *working role* group variable was selected as a control variable for the *purchasing innovations* in the concept model because different purchasing *working role* groups may have a different interpretation of purchasing innovations. *The working role* control variable is shown in the created initial conceptual model for *purchasing innovations* (Figure 1). The distribution of responder types is illustrated in Figure 2. Approximately 300 officers are estimated to serve different purchasing roles in the FTA. This means that the response rate in the survey was 35% for the personnel working with purchases.

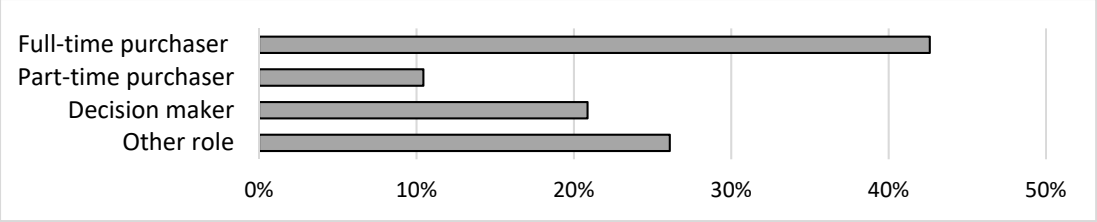


Figure 2. The distribution of responder types.

An exploratory factor analysis of the survey data was conducted to structure and confirm the model constructs. The reliability of the constructs was determined by using Cronbach's alpha values and a correlation analysis was performed on the grouped measures. IBM SPSS (v23) was used in main quantitative analyses. Data imputation methods were not applied because the respondents were required to provide answers in accordance with a Likert scale.

The differences in responses among the purchasing working role groups of respondents were examined using analysis of variance (ANOVA). The possible biases of the respondent groups, outliers, extreme values, and the skewness of responses were also examined using box plots. The responders' *working role* group variable was used as a control variable. Working role types are listed in Figure 2. The ANOVA shows that the only statistically significant difference ($p < 0.05$) between *working role* groups was between *part-time*- and *decision maker*-role types. This difference occurred in the *supply risks* measurement area. The *decision makers*-group evaluated *supply risks* to be more significant than the *part-time purchaser* -group.

The constructs identified in the factor analysis are shown in Table 3. The lowest Cronbach's alpha value was .6 and excluding the constructs with this value from the tested conceptual model was unnecessary. In exploratory factor analysis research, the Cronbach's alpha lower limit may be at the .6 level (Robinson et al., 1991; Hill et al., 2006, 139). To group the measures for the identified constructs, we performed a correlation analysis; the results are shown in Table 4.

Table 4. Correlation analysis results of group measures.

Variables	Purchasing innovations	Customer need fulfillment	Supply risks	Purchasing support	Supplier sustainable development
Customer need fulfillment	0.213* (0.022)				
Supply risks	0.038 (0.686)	-0.012 (0.900)			
Purchasing support	0.375** (0.000)	0.218* (0.019)	0.122 (0.193)		
Supplier sustainable development	0.453** (0.000)	0.337** (0.000)	0.008 (0.930)	0.310** (0.001)	
Supplier base management	0.260** (0.005)	0.277** (0.003)	-0.255** (0.006)	0.248** (0.008)	0.339** (0.000)

a Pearson correlation coefficients, P-values in parentheses.
* Significance at the 0.05 level (2-tailed).
** Significance at the 0.01 level (2-tailed)

The results of the correlation analysis showed that *purchasing support*, *supplier sustainable development, customer needs,* and *supplier base management* exhibited statistically significant correlations with *purchasing innovations* ($p < 0.05$). *Supply risks* (correlation analysis p-value = 0.686) was excluded from the conceptual model (Figure 1) because *supply risks* did not correlate with *purchasing innovations.*

The conceptual model was formed on the basis of the literature review, interview observations, Cronbach's alpha values, and the correlation analysis results. According to the literature,

purchasing performance does not explain purchasing innovations and was therefore excluded from the conceptual model. The model features *purchasing innovations* as the dependent variable and *customer need fulfillment, purchasing support, supplier sustainable development,* and *supplier base management* as the independent variables.

Survey results and findings

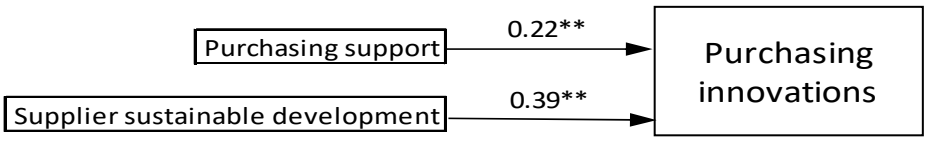
The results of the regression analysis are presented in Table 5. The R square value of the model was 0.272. We tested the multicollinearity of the model using the variance inflation factor (VIF), as shown in Table 5. A VIF value lower than 2 indicates low multicollinearity. Because all the VIF values in this work were below 2, multicollinearity was not an issue in the developed regression model.

Table 5. The results of the regression analysis.

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.75	0.61	1.22	0.225	
Supplier sustainable development	0.39	0.10	3.74	0.000	1.28
Purchasing support	0.22	0.08	2.80	0.006	1.15
Customer need	0.03	0.11	0.26	0.796	1.18
Supplier base management	0.08	0.09	0.87	0.387	1.19

As illustrated by the regression analysis results, *supplier sustainable development* and *purchasing support* exert a statistically significant effect on *purchasing innovations* ($p < 0.05$). No other factors in the conceptual model demonstrated a statistically significant effect on the dependent variable.

The conceptual model of this research (Figure 1) was developed based on the literature, the empirical interviews, and the factor analysis results of the empirical survey information (Table 1 & 2). This model was further developed with the correlation and regressions analyses of the survey data. The findings of concept model analysis showed that the constructs for *sustainable supplier development* and *purchasing support* exert a statistically significant effect on the *purchasing innovations* in the studied agency. The results of the regression analysis are seen from Table 5 and Figure 3.



** Significance at the 0.01 level (2-tailed)

Figure 3. Conceptual model for purchasing innovations

Conclusion and discussion

This study provides information about possible sources of purchasing innovations in the public sector. The empirical study focused on buyer perspective of a non-profit public transportation agency that procures a broad range of services and materials. One future research topic is to study purchasing innovation and best practices from the supplier perspective in the public sector**.** The conclusion to the research question based on the study findings is that *supplier sustainable*

development (coef .39) and *purchasing support* (coef .22) explain statistically significantly *purchasing innovations* in the studied public sector organization. The *supplier sustainable development* finding aligns with the research of Nidumolu et al. (2009), who stated that sustainability is the key driver of innovation. The finding that *purchasing support* is significantly related to purchasing innovations is the novel contribution of this research.

Interesting result of this research is that *customer need fulfillment* and *supplier base management* did not explain statistically significantly *purchasing innovations* in the created conceptual model (Figure 3). The measures of *purchasing innovations* (Table 3) focused mainly either on enabling supplier innovativeness or on innovative solutions in competition phase. The measures of *customer need fulfillment* were instead related either to planning, delivery or ending phase of the purchase, which may explain why *customer need fulfillment* does not explain *purchasing innovations* in the conceptual model of this study. The measures of *supplier base management* are related to sufficient number of suppliers and to the knowledge of current the most important suppliers. The requests for tenders of the EU public sector are open for all suppliers in the member countries of the EU. One goal of the public sector target is to treat suppliers equally and fairly in tendering also because of the EU procurement legislation. This means also that supplier base management usage in the public sector tendering is limited. In empirical interviews were told that supplier base management related decisions may occur during the competition planning phase because competition planning results can affect to the number of received bids.

The interview results of this study (Table 2) had similarities with the literature findings. According to interviews, technical dialogues with suppliers enabled innovation of suppliers. Supplier innovation potential is discussed e.g. in Lorenzoni and Lipparin (1999) and Min and Galle (1999). Interviewees thought that customer needs and requirements should be recognized before the tendering process. Early customer and supplier collaboration in service and product development had been a source of innovation (Wynstra et al., 1999; Schiele, 2010). Interview observations included supplier development and supplier development base management actions which improved supplier-buyer communication and buyer's chance to have sufficient amount of proposals. Early supplier involvement with the buyer have seen as a source of innovations (Wynstra et al., 1999; Schiele, 2010). In the conducted interviews were not reported practices, which would have helped purchasers to concentrate to a few suppliers that exhibit a strong potential for innovativeness. This practice has been mentioned in the literature (Schiele, 2006). In the EU a public buyer may use e.g. negotiation or restricted procurement procedures, defined by the procurement law. These procurement procedures may help the buyer to concentrate on and have more buyer-offeror dialogues with certain suppliers during the tendering process. Negotiation procedures require often substantially more purchasing support resources than conventional open or restricted tendering procedures. Sufficient purchasing support resources were considered also as a good practice in the interviews and in the several papers (Inemek and Matthyssens, 2013; Krause et al., 2000; Dyer and Hatch, 2006).

The current work corroborates this perspective by providing evidence of the connection between sustainability and innovation in the procurement context of the public sector. From a managerial perspective, sustainable procurement is aimed at evaluating the economic, environmental, and social aspects of purchasing. Unsurprisingly, then, new environment-friendly materials and energy sources that require purchasing solutions may be thought of as falling under innovative procurement that creates additional value. The values and strategies of an organization may, to some extent, explain why sustainable procurement solutions are regarded as value-adding

components by personnel. Responsible procurement may be associated with corporate social responsibility, which revolves around social, economic and environmental effects on society. The effects of responsible actions improve competitiveness, risk management, transparency, and open communication with stakeholders.

Sustainable purchasing takes environmental aspects into consideration. *Supplier sustainable development* explains the *purchasing innovations* in the studied public organization possibly because public organization procurement must take into consideration the environmental and legal restrictions of a project during a purchase life cycle. In the FTA, the possible environmental, social, ethical and lean values held by purchasing personnel may partly explain why a new and improved sustainable solution is considered innovative or not. In public procurement, social sustainability factors are considered also for legislative reasons. For example, a purchaser is required to verify that a tenderer has fulfilled the labour obligations in accordance with the Contractor's Obligations and Liability Act.

In practice, innovativeness and value creation in purchasing can be a challenging task. This study indicated that considering issues related to *supplier sustainable development* and *purchasing support* in innovative purchase planning is beneficial. Similar directives are stipulated in general purchasing policies that mandate adherence to sustainable purchasing principles and the adequate consideration of supplier markets in all the purchases of the studied agency. The results suggest that value-adding *purchasing innovations* are enabled by sufficient and skilled *purchasing support* resources. Sufficient and skilled professional support resources, including juridical, are equally valuable in the different purchase process phases, as determined from the interviews. Without sufficient skilled professionals, public purchasing innovation would likely occur less often and with less positive effects on society. Fortunately, procurement professionalism and know-how have received attention from the Finnish government and the Finnish purchasing sector. In this context, purchasing services are frequently seen as value-adding services.

As with any study, the current research has certain limitations. First, the applicability of the results is restricted given that the study is based exclusively on a large public sector organization. Therefore, generalizability may not extend to other types of public organizations. Second, the results on the identified antecedents of purchasing innovations may be beneficial to an organization similar to the FTA but not necessarily applicable to public sector organizations that differ from the studied agency. Because the sources of *purchasing innovations* may vary from one public sector organization to another, these antecedents require further study.

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Authors:

Mika Matela *, Finnish Transport Agency, Raatimiehenkatu 23, 53100 Lappeenranta, Finland, matela@iki.fi, +358295343137, * Corresponding author.

Janne Posio, Finnish Transport Agency, Yliopistonkatu 38, 33100 Tampere, Finland, janne.posio@fta.fi, +358295343622

Jukka Hallikas, Lappeenranta University of Technology, Skinnarilankatu 34, 53850 Lappeenranta, Finland, hallikas@lut.fi, +358405507499

The role of fairness in buyer-supplier relationships in times of crisis

Aristides Matopoulos[1], Simone Didonet[2], Vaios Tsanasidis[3] Andrew Fearne[4]

[1]Aston Logistics & Systems Institute, Aston University, Aston Triangle, Birmingham, B4 7ET, UK. Email: a.matopoulos@aston.ac.uk
[2]Department of Business Administration Faculty of Applied Social Sciences Federal University of Parana, Brazil. Email: simonedidonet@ufpr.br
[3]The International Faculty of the University of Sheffield, CITY College, 3 Leontos Sofou, 546 26 Thessaloniki, Greece Email: vtsanasidis@city.academic.gr
[4]Norwich Business School, University of East Anglia, Norwich Research Park, Norwich, NR4 7TJ, UK. Email: A.Fearne@uea.ac.uk

Summary
This research explores the importance of perceived organisational justice in times of crises, when supplier commitment and strategic orientation have the potential to offset the negative impact of external pressures on business performance. We draw data from a survey of 117 suppliers of a major Greek grocery retailer. The retail sector in Green has been under enormous pressure during the recession. This provides a very interesting setting for exploring the implications for buyer-supplier relationships. Results show that higher levels of perceived justice by the suppliers are associated with higher levels of commitment and long-term business orientation, which in turn, leads to higher performance outcomes. Moreover, the strength of relationships appears to offset the potential (negative) impact of the financial crisis on performance.

Keywords: buyer-supplier relationships, organisational justice, Greek financial crisis, retail supply chains

Introduction

The "Marmite shortage crisis" in the UK, and Volkswagen's dispute in Germany with two of its suppliers in 2016 illustrated the important role of justice in managing buyer–supplier relationships in supply chains. Both incidents showed how fragile buyer-supplier relationships can be and also how seemingly strong, functioning, long-term relationships can quickly become weak and dysfunctional bringing severe disruption. Conflicts and tensions between buyers and suppliers are not uncommon and yet in the literature there is not much empirical research about the role of justice in buyer-supplier relationships particularly in times of economic crisis. Trkman and McCormack (2009) for example, explored the issue of supply risk management for car manufacturers within the context of an economic crisis. Using contingency theory they proposed a framework for the assessment of supplier risk of disruption. Blome and Schoenherr (2011) building on their work investigated how severe developments like the financial crisis affect risk management and they explored both negative and potentially positive impacts on the buying firm. In both cases however the emphasis was on risk management and not on how the buyer-supplier relationships may be affected. The research by Servais and Jensen (2012) investigated the role of buyer-supplier cooperation, conflict and trust in customer satisfaction by using data collected in a period of recession, but without considering organisational justice. More recently, Ellram and Krause (2014), explored how long-term relationships responded to an economic downturn and their results suggested that the balance is delicate; a stressful event, like the recent financial crisis, may reveal surprising relationship vulnerabilities.

In this research we add to this body of literature, providing empirical evidence, by focusing on the relationship between a grocery retailer and its suppliers in times of acute economic crisis. The primary purpose is to empirically investigate how the perception of fairness (or justice), in a buyer-supplier relationship influences suppliers' commitment and their performance. We examine the above in the context of the Greek food retail sector, which has been affected by one of most severe and long lasting financial crisis in Europe due to the unprecedented reduction in household consumption (Eurostat, 2017). This potentially creates an environment where conflicts and disagreements are more likely to happen and escalate.

We anchor our research on the theory of organisational justice in order to explain the relational linkages between buyers and suppliers and we draw data from a survey of 117 suppliers of a major Greek retailer (hereinafter referred to as Retailer-Co). Results show that that higher levels of perceived justice by the suppliers are positively associated with higher levels of commitment and long-term business orientation, which in turn, leads to higher performance outcomes. It is also shows that during the crisis the conflicts and disagreements have increased. The paper proceeds as follows. In the next section we provide a review of the literature focusing on the key elements of organisational justice and the link to performance. The paper then presents the data collection process, followed by the results and discussion where we present both managerial and research implications.

Literature review and conceptual framework

The retail sector during the global financial crisis: the case of Greece

The retail sector was one of the sectors affected the most during the recent global financial crisis, which put an end to 15 years of uninterrupted prosperity (Flatters and Willmott, 2009). This was largely because of consumers restraining themselves from excessive spending (Burt et al. 2010), often through a more price-conscious orientation, buying less expensive brands in order to reduce household expenses and save money (Bowmer, 2011). In a similar vein in Greece, the dramatic depreciation that followed the outbreak of the financial crisis drastically reduced consumer incomes and spending. After a decade of rapid growth (2000-2008), retail trade in Greece contracted by 5 per cent per year in terms of volume during the recession (Mylonas and Tzakou-Lambropoulou, 2016). Food sales dropped by 18 percent since 2009 (13.15 billion euros), in 2016 alone, food sales dropped 4 percent with a further 2-3 percent decrease estimated for 2017 (Nielsen report, 2017). In parallel to the economic crisis, the Greek retail sector also went through a period of consolidation with a number of companies being pushed out of the market (e.g. the number of SME retailers during the period 2008-2013 dropped by circa 30,000 stores) or entering into strategic mergers and acquisitions in order to survive the pressures of the recession (Mylonas and Tzakou-Lambropoulou, 2016, Euromonitor, 2018). Not surprisingly the impact of the crisis in many cases was cascaded down to suppliers. For example, the bankruptcy of Marinopoulos (Greece's largest supermarket chain) left 2,000 suppliers unpaid with 50 percent of Marinopoulos's debts to them been written off. Several suppliers, mainly small businesses, were on the brink of bankruptcy.

Organisational justice and performance

In examining the nature of buyer-supplier relationships, a well-established stream of literature identifies a continuum ranging from discrete to relational behavior (Dwyer et al 1987; Siguaw et al. 2003). However, firms are struggling to develop and sustain collaborative initiatives towards the end of the relational continuum (Spekman and Carraway 2006) as many buyers continue to abuse their position of power and strangle suppliers with short term, cost-driven decisions (Rossetti and Choi 2005), particularly with regards to retailer-supplier relationships (Corsten and Kumar 2005). Ultimately, Giunipero and Eltantawy (2004) warn that this is

detrimental to long term competitiveness given that the full capabilities of a supplier will be undermined. Therefore, effective collaboration requires more than just co-ordination at the operational level of the relationship, but intent on the part of boundary spanners in buyer organizations to build strong relationships, whereby attitudes such as trust and commitment can exist. This positive behavioral intent is critical to developing and sustaining collaborative initiatives, as it encourages partners to dedicate assets on behalf of others in the chain, thus creating economic value (Spekman and Davis 2004).

One important dimension affecting an individual's actions and reactions is how fairly they perceive treatment by the other, often more powerful party. The theory of organizational justice (or fairness) has been used extensively in the intra organizational literature, where the traditional focus has been on the role of fairness in the workplace. The assumption is that employees' perceptions of fairness will impact upon their behavior, and therefore on organsational outcomes and performance (Colquitt 2001; Konovsky 2000; Masterson et al. 2000; Thiabaut and Walker 1975). Employees who perceive they are treated fairly contribute to performance through positive behaviors, such as long term commitment or discretionary behaviors. Likewise, for those employees who feel they are being treated unfairly, resultant damaging retaliatory behaviors will negatively impact upon organizational performance (LePine et al. 2002; Podsakoff et al. 2000). In the context of this study, the theory of organisational justice is applied to inter-organisational relationships. It is proposed that the concept of fairness, or justice, will influence the strength of buyer-supplier relationships and in particular, supplier commitment – in good times as well as bad.

Greenberg (1993) and then Colquit (2001) conceptualised organisational justice in four distinct components: a) distributive justice, b) procedural justice, c) interpersonal justice and d) informational justice. Previous research on organisational justice comes with shortcomings and gaps. For example, Lusch (2000) and Brown and Cobb (2006) focused exclusively on the consequences, but only for limited number of justice dimensions. The implications for firm performance have also not received much attention and very few studies (Griffith et. al, 2006) have examined the impact of fairness on firm performance. The research by Chad and Golicic (2010) with participants from the construction industry also aspired to link the performance with the perception of justice using the social capital theory, however, their model did not consider variables tied to relationship strength such as information sharing and commitment.

In addition to the four components of organisational justice and in line with the study by Hornibrook et al. (2009), we consider commitment as a mediator between perceived organisational justice and performance. In addition, we recognise the importance of strategic alignment and the categorisation of customers (buyers) on the part of suppliers (sellers). In line with the study by Zanquetto and Fearne (2003) we argue that suppliers who perceive a relationship to be of strategic (long term) importance are more likely to allocate resources to support the development of that relationship, will be reciprocated by the buyer, in the way they treat them – distributing the financial benefits fairly (distributive justice), giving them a voice (procedural justice), explaining their decisions (informational justice) and treating them with respect (inter-personal justice).

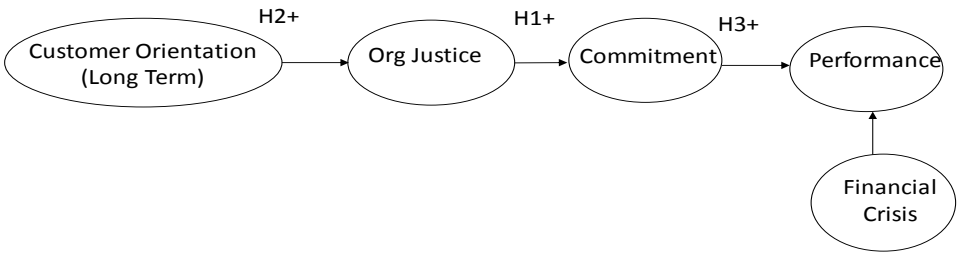
The resulting conceptual framework is illustrated in Figure 1 and the hypotheses we seek to formally test are as follows:

H1: Organisational justice positively influences commitment.

H2: Customer orientation (a supplier's perception of the strategic importance of the relationship) is an antecedent of organisational justice.

H3: Commitment positively influences performance.

Figure 1. Conceptual Framework



Methodology

Data was collected during the summer/autumn of 2016 via a survey of Retailer-Co's suppliers. At the beginning of the research, we established a database of 250 food manufacturers and processors operating in the sector through industry associations. These companies operated in different food sub-sectors (e.g. processed fruits and vegetables, dairy products, fresh and processed salads and dressings, bakeries, snack and confectioneries). Almost all (98.3%) of respondents regarded the supermarket as a key customer. A total of 119 questionnaires were completed, representing a response rate of 47.2%. Out of the 119 questionnaires completed two were excluded from the sample due to missing values and so a total of 117 questionnaires were analysed. The average time to complete the questionnaire was 20 minutes. Questionnaires were sent to through a link to an online survey. There were two rounds of data collection. The participants received the first reminder about three weeks after sending the survey link. The second reminder was sent in about three weeks following the first reminder. The participants were also given the opportunity to receive the results of the survey.

The survey included 25 questions both closed (using 1-5 likert scale) and open ended including questions about the company. The questionnaire consisted of five parts. The first one included questions that referred to the profile of the respondents and of the company. The following section emphasised on information sharing issues (e.g. the level of perceived trust and reliance). The third part aimed at identifying suppliers' perception about their relationship with the buyer their level of commitment. In this section the main aspects of the distributive, procedural and interpersonal justice were being assessed and the constructs were based on previous research (Colquitt, 2001; Griffith and Lusch, 2000). Section four captured the implications of economic crisis and how it influenced the buyer-suppliers relationship. Finally, the sixth section contained questions related to operational and financial performance where we gathered data about the following four key performance indicators: i) The supplier's sales revenues related to last year's sales and compared with the current year's performance of the rest market competitors, ii) the service level related to the proportion of out of stocks situations compared with the previous year's performance and iii) the volume of quality issues that is being observed during the year, iv) the on – time delivery to Retailer-Co's distribution centres. For the development of these questions and the agreement on the relevant key performance indicators we interviewed the director of procurement from Retailer-Co and also the logistics director for one of the main distribution centres.

Organisational performance refers to how well a firm achieves its goals. Past researches have measured organisational performance using primarily financial indicators such as return on investment (ROI), market share, profit margin on sales (Sánchez and Pérez, 2005). This has been particularly the case in the innovation literature where the amount of sales (or sales turnover) generated from innovations has been one of the most common measures of business performance (Griffin, 1997). In this research, in addition to growth related indicators (e.g. market share growth, sales growth, new customers) we consider profitability-based measures

(e.g. profitability, return on sales) but also the manager's perception of the organisation's overall performance.

Findings

Sample description

Table 1 presents the sectors represented in the sample with canned food products having the highest frequency of responding companies, followed sausages and dairy products and non-food products. There were also 5 companies, participants from which responded they did not belong to any of the listed food subsectors.

Table 1 Food sub-sectors represented in the sample

Sector	Frequency	Percentage
Canned food products	53	45.3
Sausages and dairy products	23	19.6
Non-food products	23	19.6
Fresh produce	7	5.9
Fresh meat	6	5.1
Other	5	4.5

Table 2 presents the years the company has been in operation at the time of data collection and the great majority of companies represented in the research are well-established business with more than 10 years in operation.

Table 2 Participant companies' years in operation

Sector	Frequency	Percentage
Less than 5 years	4	3.4
5 to 10 years	8	6.8
10 to 20 years	18	15.4
More than 20 years	87	74.4

The measurement model

Partial Last Square (PLS) path modeling was chosen for the data analysis using the Smart PLS 2.0 software. The internal consistency and the convergent and discriminant validity of the measurement model were assessed by using the PLS approach (see Table 3). It is important to note that the construct 'customer orientantion (long term)' was considered as a dummy variable in the model. Furthermore, organisational justice was considered as a second-order construct taking into account its dimensions (distributive, procedural, informational, inter-personal).

Table 3. Construct-level measurement statistics

Constructs	Cronbach alpha	CR	CustOr	OrgJustice	Commitment	Perf
Cust Orient	1.00	1.00	**1.00**			
OrgJustice	.94	.95	-0.11	**.74**		
Commitment	.88	.91	-0.21	0.60	**.77**	
Performance	.83	.88	-0.21	0.44	0.52	**.77**

Note: Bold numbers on the diagonal show the squared root of AVE; CR = composite reliability

The results showed in Table 3 exceed the recommended threshold values of .70 for Cronbach's alpha, .70 for CR and .50 for AVE (Bagozzi and Yi, 2012). Additionally, the values of square root of AVE were greater than the highest correlation between one construct and the other constructs which suggest discriminant validity (Fornell and Larcker, 1981). In table 4 we present the results of the proposed model.

Table 4. Results of the hypotheses test

Hypothesis and Path	Coefficient (β)	S.D.	t-value	p-value	Status
H1. OrgJustice -> commitment	0.596	0.059	10.060	0.000	Supported
H2. CustOr -> OrgJustice	-0.109	0.097	1.133	0.257	Rejected
H3. Commitment -> perf	0.483	0.074	6.523	0.000	Supported

S.D. = standard deviation

The results of the hypothesized model (see table 4) revealed that organisational justice strongly influences commitment. The coefficient of 0.596 and t-value of 10.06 lead us to accept H1. In addition, higher levels of are strongly associated with higher levels of performance of suppliers. The coefficient of 0.483 and t-value of 6.523 confirm H3. However, results did not support the hypothesis that the strategic categorisation of the relationship as long term would result in higher levels of perceived organisational justice. The non-significant influence of this perspective on organisational justice lead us to reject H2 (β = -0.109; t-value=1.133). Regarding the potential impact of the financial crisis, the results revealed no significant impact on performance, leading us to conclude that the strength of relationships served to 'mediate' the impact of the financial crisis on suppliers performance with this particular retailer.

Discussion/Conclusions

Our results support the findings from previous research regarding the benefits of strong inter-organisational relationships for business performance (Liu et al 2016, Yilmaz et al. 2004). Specifically, they suggest that (even) in times of crisis suppliers who perceive themselves to be fairly treated by their customers will devote additional resources to 'go the extra mile' for the benefit of both partners in the trading relationship. The commitment that comes from being fairly treated pays dividends in 'normal' trading environments by facilitating the sharing of risk, joint decision-taking and the collaborative allocation of resources. However, as previous research has suggested, it is in times of crisis that the citizenship behaviours of committed suppliers are most appreciated and duly rewarded, through reciprocal risk sharing and corrective actions designed to ease the pain.

The theory of organisational justice is an attractive lens through which inter-organisational relationships can be explored. The separation of organisational (distributive and procedural) and personal (informational and inter-personal elements of relationships) is particularly valuable in the context of supermarket supply chains and fast moving consumer goods, where transactions are many and margins are tight and individuals (buyers and account managers) are under significant pressure to deliver results over short time horizons. This pressure can only intensify in times of economic uncertainty and financial austerity. Yet, the results of this study suggest that, with the right strategy, suppliers can withstand these pressures, provided they are treated fairly by their (more powerful) trading partners.

Not withstanding the novel context of this study and the significance of the results reported here, the study is not without its limitations. First of all, the research was restricted to

one retailer and their relationship with a small number of suppliers, which limits to some extent our ability to make broader generalisations to other contexts. In addition, the sample size in this research was relatively small which limited our ability to do further analysis. Further research may include data collection from other suppliers to Retailer-Co, but also from the buyers within the supermarket involved in the study. This will hopefully shed light on the specific initiatives undertaken to counter the effects of the financial crisis without recourse to the use of power and the (unfair) extraction of concessions from their suppliers.

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R&D collaboration in the supply chain: involving customers and suppliers in green product development

Abstract

The aim of the paper is to illustrate how collaboration in the supply chain enables green product development. A single case study is conducted at a world leading industrial tool manufacturer. The project under study is the development of a product that is new to the firm, a new application, that involves a world leading automotive manufacturing customer as well as two specialized suppliers. The study points to the importance of managing knowledge sharing with external partners as well as within the focal firm. In addition, relationships with external partners are managed differently depending on their scope of contribution in the product development project.

Keywords: innovation; supplier involvement; cross-functional

Submission category: competitive paper

Introduction

Sustainability is a growing concern around the world for governments, citizens and firms. By addressing sustainability issues, firms find opportunities to both be more competitive and address climate issues more effectively (Porter & Van der Linde, 1995). The rapid use of digitalization in industrial settings has enabled development of products aimed towards more sustainable operations. Technological developments, new regulations as well as increased push from customers and consumers for greener products require firms to develop more sustainable products. In this paper, sustainability refers to environmental sustainability and sustainable innovation is also referred to as green product development.

Green collaboration with external partners are beneficial to firms' performance (Dangelico & Pontrandolfo, 2015). To succeed in developing green products, firms need to collaborate with external organisations, as no firm can have all knowledge in-house. Prajogo et al. (2014) point to the need for collaboration beyond the firm's level, primarily to involve customers and suppliers in green development efforts. In fact, studies point out that collaboration seems to be more important in green developments than in other types of developments (Horbach, 2008; Petruzzelli et al., 2011). There is extensive literature on supplier involvement (Bengtsson et al., 2013; Johnsen, 2009; Melander & Lakemond, 2015) and customer involvement (Eslami & Lakemond, 2016; Laage-Hellman et al., 2014; Öberg, 2010) in product development. However, fewer studies have investigated collaborative green product developments. Collaborations in green product developments are important, as these products are characterized by higher levels of complexity and novelty, requiring a number of knowledge bases to be integrated (Petruzzelli et al., 2011). Studies show that involving suppliers and customers in green developments bring economic benefits to firms (Zhu et al., 2012). In joint developments, supplier and customers contribute with new knowledge. Suppliers tend to be included in collaborative efforts to provide new technology and new material (Foster & Green, 2000; Geffen & Rothenberg, 2000). Similarly, customers provide knowledge about markets, products and services (Dai et al., 2015).

Few studies have included customer and supplier collaborations in the same green product development project while also studying internal organizational issues. In fact, Mazzanti and Zoboli (2009) point out that industrial relations in green developments is highly under

investigated. Hence, there seems to be a shortage of studies combining the study of multiple external and internal considerations in collaborative green product development. The aim of this paper is to illustrate how technological developments through digitalization and collaboration in the supply chain enables green product development. The paper takes a qualitative approach and is based on a case study which illustrates customer and supplier involvement in green product development. Cross-functional collaborations within the focal firm are also investigated.

The paper is structured as follows. First, theory on collaborations in product development are presented, focusing on external and internal collaborations. Thereafter, the methodology is described. The case of DigiQual is presented, followed by the analysis. Finally, conclusions are presented.

Theory

Collaborative product development

In collaborative product development, organisations jointly develop new products. Several studies point to an increased need for firms to involve external actors in product development (Chesbrough, 2003; Gupta & Wilemon, 1990). Inter-organisational collaborations can involve a number of actors, for instance suppliers, universities, customers, competitors or other organisations. Faems et al. (2005) show that the more firms collaborate with different external partners, the more likely they are to create new or improved products that become a market success. Similarly, Becker and Dietz (2004) point out that external collaborations in product development enhance the probability of creating new products.

External collaborators in the supply chain are important sources for product development. Research point to suppliers' importance (Bengtsson et al., 2013; Cuervo-Cazurra & Un, 2010), and the importance of customers (Belderbos et al., 2004; Laage-Hellman et al., 2014). A study comparing collaboration in product development with suppliers, customers, competitors and universities show that collaborations with suppliers have the highest positive impact on product development, followed by university collaborations (Un et al., 2010). The authors also find that customers do not appear to affect product development, while competitors seem to harm the firms' product development. It is shown that collaboration with partners that are similar to the focal firm gives fewer benefits than partners that are diverse since similar firms provide a less diverse pools of information and know-how (Baum et al., 2000). However, it may be more difficult to collaborate with firms that are different than with firms that are similar, since similar firms share knowledge bases and pre-understandings (Melander, 2014). Proximity is a concept that has been identified as important in external collaborations (Knoben & Oerlemans, 2006). These authors suggest three types of proximity dimensions for inter-organisational collaborations: technological proximity, geographical proximity and organisational proximity.

Green product development

Involving external partners in green product development projects provides benefits such as access to knowledge, enabling the development of new products and faster introduction to the market. These collaborations provide opportunities for new designs that are more energy efficient and environmental friendly (Florida, 1996). By collaborating, firms access diverse knowledge resources, which is important in order for firms to improve their green design capabilities (Lenox & Ehrenfeld, 1997). Studies show that accessing knowledge and increasing the firm's knowledge is an important reason for collaborating in green product development (Chadha, 2011; Chen & Hung, 2014; Dangelico et al., 2013; Melander, 2017).

Studies show that collaborative partners in green product developments often are suppliers and customers (Melander, 2017; Prajogo et al., 2014). By collaborating with suppliers, firms can improve their environmental performance (Geffen & Rothenberg, 2000). Supplier often contribute with new technologies and designs that decrease the use of energy and CO_2 emissions. Suppliers also contribute with more environmental friendly material and by providing material with less toxic waste. Collaboration with customers enables firms to increase their knowledge about the market and changes in green products and services (Dai et al., 2015). Firms involve external partners at different times during the development project. However, Lee and Kim (2011) suggest that external collaborators should be included from the concept stage to the prototype stage.

Literature on collaborative green product development reveals some tensions. There are disagreements on the importance of collaborating with external partners. Many studies show to the importance of collaborating with external partners in green product development (Dangelico, 2016; Horbach, 2008; Melander, 2017; Segarra-Ona et al., 2014; Wu, 2013). In fact, a study by De Marchi (2012) point out that collaboration with external partners are more important in green product developments than for regular product developments. In the same line, a study by Petruzzelli et al. (2011) shows that green product developments in fact have higher degrees of collaboration compared to other developments. In contrast, a study by Cuerva et al. (2014) point out that collaboration is not important for green product development. Whether inter-firm collaboration is beneficial or not, firms still need a well-functioning intra-firm collaboration. Therefore, it is not surprising that many scholars claim that firms need not only to manage external relationships, but also internal cross-functional relationships (Chadha, 2011; Walton et al., 1998; Wu, 2013; Zhu & Sarkis, 2006).

Cross-functional collaboration

Internal collaboration within firms between functions are important, as these are identified as mechanisms for both incorporating knowledge from external collaborations as well as initiating new external collaborations (Hillebrand & Biemans, 2003). There are many studies focusing on cross-functional collaboration in product developments (see e.g. Lovelace et al., 2001; Sethi et al., 2001). There are a number of studies identifying important factors for cross-functional collaboration. In collaborative efforts, physical proximity facilitates coordination and interaction between functions (Okhuysen & Bechky, 2009). Similarly, alignment of multiple functions within the firm is important (Storbacka et al., 2011). Internal facilitators that have effect on cross-functional collaboration in NPD are identified as a firm's evaluation criteria, reward structures and management expectations (Song et al., 1997). Goals, rules and procedures and physical proximity impact collaboration in cross-functional teams (Pinto et al., 1993).

McDonough (2000) reviews literature on cross-functional collaboration in new product development and identifies a number of factors influencing team success. These factors are categorized into "stage setters", "enablers" and "team behaviors". Stage setters include project goals, empowerment, human resources and climate. Enablers consist of team leaders, senior management support and champions. Finally, team behaviors include cooperation, commitment, ownership and respect/trust. Teams with greater levels of functional diversity tend to have greater level of disagreements (Lovelace et al., 2001). The authors show that the effect of that disagreement on the team's performance depends on three things: how the disagreement is being communicated, how free the team members are to express doubts and how effective the team leader is perceived to be. Sethi et al. (2001) investigate cross-functional development teams and identify contextual influences and team characteristics that affects innovativeness. Contextual influences include extent of project monitoring, customers' influence and

encouragement to take risk. Team characteristics include social cohesion, superordinate identity and functional diversity. However, the authors find that functional diversity has no effect on innovativeness. Although many studies have been made on cross-functional collaborations and what makes these collaborations successful, there is no clear answer on how firms should act. That is due partly to that internal collaboration between functions in projects is a complex and dynamic process (Calamel et al., 2012).

Methodology

A qualitative case study was conducted as it allows for capturing the phenomenon in a real-life context (Halinen & Törnroos, 2005) and allows for understanding dynamics in a specific setting (Eisenhardt, 1989). A firm called IndTool (fictitious name) was selected as it is a leading global manufacturing firm that is used to collaborate with customers and suppliers in green product development. IndTool has customers with high demand on sustainable development and IndTool's suppliers are leading in new technologies and sustainability efforts. IndTool is a manufacturer of industrial tools. A purposive sampling strategy was used to select a case that was particularly instructive for this research, aimed to understand green product development involving customers and suppliers (Patton, 2002). In addition, the case involves a number of internal functions and organizations at different geographical locations at IndTool. Hence, the case aims to illustrate contributions from customers and suppliers in green product development as well as internal relationships (Siggelkow, 2007). To ensure that rich data could be attained, IndTool participated in the case sampling.

The product under study is a quality product aimed towards automotive manufacturing plants. IndTool develops a number of quality products, but this product, here called DigiQual, has an application that is new to IndTool. Hence, collaborations with customers and suppliers were very important to access knowledge about the new application as well as new technologies. An interview guide was made that incorporated the main topics (external and internal collaboration) while allowing for flexibility and follow-up questions. Semi-structured interviews were conducted with nine knowledgeable individuals at IndTool. The respondent and their organizational belonging is shown in Table 1.

Respondent	Organizational location
Sales manager	US
Sales zone manager	US
Product marketing specialist	US
After sales specialist	US
Product specialist	US
R&D manager	Sweden
R&D project manager	Sweden
Voice of the customer manager	Sweden
Business manager	Italy

Table 1Respondent and their organizational belonging

All interviews were made face-to-face except one interview that was made by phone. The interviews lasted between one to three hours. Two individuals were interviewed multiple times to follow-up the project's progress. In addition, documents were studied. These documents consisted of project reports, internal documents and practices for external collaborations. A case report was written where narratives were presented to include rich and detailed descriptions of the project.

A within case analysis was conducted where data was analyzed, organized, categorized and coded (Eisenhardt, 1989). Data was coded and structured according to time perspective and external involvement as well as cross-functional collaborations to create a story from the occurrences in the project (Miles & Huberman, 1984). By using interview-data, microanalysis was made that took the interviewees' interpretations of the project into consideration (Strauss & Corbin, 1998). Empirical data and theory were systematically compared in an iterative process (Dubois & Gadde, 2002; Eisenhardt, 1989). Key variables from theory was used to categorized data that was displayed in a meta-matrix. A case study database was used to store collected and analyzed data (Yin, 2009).

DigiQual: a green product development

Organizations involved in the development of DigiQual

One of IndTool's most important products is a hand-held tool used in various production lines for manufacturing in for instance the automotive industry. The product under study is an accessory that belongs to a product group closely associated with the hand-held tool. The product is a measurement tool that can be described as having a hardware part and a software part that are integrated. The product, DigiQual, is classified as quality equipment. IndTool is a large global company with clear boundaries for their products, where it is clear within IndTool which organizations that owns which type of products. However, there is some flexibility as well, as it is possible for organizations to do developments for their national market. For example, a specific factory is responsible for a product range globally. But a national entity is allowed to develop a product within that range for their own national market if needed.

For this case story, three different organizational locations have been involved: US, Italy and Sweden. The headquarter is located in Sweden, where the hand-held tool is developed and manufactured. For the hand-held tool, there is a global market team and a global product owner also located here. The global product owner is mainly concerned with the technical aspects of the product, future development, production and quality. The global market team supports local market teams around the world. They contact the different local markets and gather information about the customers' needs. The global market team makes sure that IndTool has the right product offerings and collaborates with the global product owner to ensure that R&D efforts are focused on what the market requests. The factory and R&D team for quality assurance products is located in Italy. They also have a global market team and global product owners for their products. The US organization consists of application center, service, administration and market support. There is a local market team and product support in the US. Within IndTool, US is the biggest customer center. It was IndTool's US organization developed the DigiQual product, which is in the product range belonging to the Italian organization.

External collaboration partners in the development of DigiQual are a customer and two suppliers. The customer is one of the world's largest automotive manufacturers. The customer's manufacturing plant that was involved is located in the US. The customer has close collaboration with IndTool's US organization, with almost daily communication between the two firms. The suppliers are two small specialized suppliers located in the US. One supplier provided hardware, where specifications are quite clear. The other supplier provides software for DigiQual, here the relationship is of a more collaborative nature, where IndTool and the supplier has a strategic partnership. The supplier is leading in the field of wireless handheld communication devices for industrial applications.

The product development

Sales representatives in US visit their customers on a daily basis and have very good contacts within these firms. When visiting the customer in this case, sales representatives identified the potential for the new sale, a measurement instrument. In order to further develop the idea of this product, IndTool started a partnership with the customer. The customer provided input and influenced the development of DigiQual. The customer pushed for a sustainable product and explained the needs from the factory and manufacturing processes. The customer also described what the customer would like to be able to do with the new product and which applications that would be useful, as well as technological limitation in the plant. Together with the customer IndTool developed a set of needs and features for the product. The customer also participated in the test phase of DigiQual.

Previously, most data collection tasks were done manually within the customer's automotive plant. Existing technologies have made it possible for digital data collection, but there was limited use of software for this purpose. Before DigiQual, IndTool did not have a product for this type of data collection in their product portfolio, and thus R&D investments were needed. The main enabling factors for this product was technical development and the transformation in digitalization happening at the customer's factories. The customer wanted to integrate software into handheld hardware to be used in a number of data collection processes. IndTool also knew that the customer wanted flexibility in the product and that its quality operations should be more sustainable. DigiQual is a little hand-held device with software, scanner and Bluetooth connection.

The development of DigiQual within IndTool was not a clear path. Sales representatives presented the idea of a new product, DigiQual, to the US sales group. By developing this product IndTool could provide quality assurance to more areas in the automotive plant. Before, IndTool provided quality measurement tools for torque, but with a new product they could provide quality measurements in other areas of the plant as well. The US sales contacted the global product owner in Sweden to ask them to start a development project for this new product. However, this product was not within the product range for the Swedish factory and R&D. It was another subsidiary in Italy that made the accessories, which has close collaborations with the Swedish organization.

The US organization then contacted the Italian global product owner and asked them to develop the product. There was limited response from the Italian organization. The US organization got some backing from the Swedish organization, but was not able to influence the Italian organization. The Italian R&D was not interested in developing this product, pointing out that they did not have the time for this R&D project as they are busy focusing on their other products. After several attempts to get attention to this new product idea without response, the US organization decided to develop the product themselves.

Since IndTool's US organization had formed a partnership with the customer and had a good idea of what type of product they wanted to develop, they decided to develop the product in the US limited to the US market. By developing it themselves they could to get a product faster to the customers. By involving the customer and two expert suppliers to provide the hardware and software for the product, the US organization managed to develop DigiQual for the local US market.

A local product becoming global

DigiQual was introduced to the US market, first to the customer who participated in the product development, and then to other customers. DigiQual sells well in the US for being new to the

market. It has been a very good development for this type of product. The customer that participated in DigiQual's development wants to buy this product for their factories in other countries. But IndTool only allows for DigiQual to be sold to the US market. However, for the customer, IndTool is a global company who should be able to sell their products globally.

The success of DigiQual and future potential of digital quality product has gotten IndTool's Italian R&D's attention. After DigiQual's introduction to the US market, IndTool's Italian R&D has now started their own R&D project to develop a similar measurement tool for the global market. The Italian R&D is developing software for the new hand-held tool where the US sales provide input from their experience with DigiQual and input from customers. The new product will be more complex than DigiQual and will be able to complement a wider range of products. It is a big undertaking for IndTool, as the product needs to be able to communicate with a number of different applications and software. Once the new product has been developed it will replace DigiQual in the US, and it will be sold globally to automotive manufacturers, as well as to similar industries.

Analysis: collaborative product development

Digital technologies

DigiQual is a new product enabled through digitalization with the aim to have clear sustainability gains for the customer. Through close customer collaboration, IndTool managed to develop a product that was new to the firm, had new applications and provided a number of benefits for the customer. Hence, IndTool created a new product category and thus entered a new market, something which has been pointed out as important for green product developments (Dangelico et al., 2013). DigiQual, the quality assurance product in automotive operations, was able to replace a number of manual data collection tools and operations.

The customer performs a large number of inspections, data collections and documentations in the production processes at the automotive factory. Prior studies have identified technological opportunities as enablers for green product developments (Chavez et al., 2016; Dangelico & Pujari, 2010). Before DigiQual, the customer applied a very limited use of digitalization for quality operations, although the technologies for digital data collection and documentation were available. Instead, pen and paper were used for visual inspection documentations. DigiQual has replaced these manual proceedings and enabled higher quality documentation by providing bar code scanning, camera for taking pictures, Wi-Fi for providing locations and uploading forms and pictures. Previously, data as well as visual defect descriptions were manually loaded to computers for storage. Hence, DigiQual has provided better logging of defect products.

For quality assurance, the customer conducts a number of measurements manually during the manufacturing process. These were previously written on paper and later transferred manually to a computer for uploading in the system. DigiQual can conduct some of these measurements and log these directly to the network. Other measurements can be read by DigiQual and uploaded, or put manually in DigiQual for direct upload to the network. Similarly, inspections are made in vast carparks of newly produced cars. Operators have to locate a specific car and check some specific aspects of that car. Previously, there has been a problem of finding the correct vehicle and operators have cheated the system by simply claiming to have performed an inspection without actually having located the vehicle. By using DigiQual, operators can easily locate the vehicle by tracking it. Photos of the vehicle ensures that the operator has located the correct vehicle as well as ensures that inspections of specific parts have been conducted by uploading photos of these parts. Hence, DigiQual has improved quality and accuracy of inspections. DigiQual has improved quality assurance as well as traceability of

repairs by using barcode scanner, where date, time, repairs, spare parts and operators are logged into the system. Hence, the new product improves productivity, reduces costs and risks, which is in line with what is pointed out as important in previous studies of green product developments (Florida, 1996). Quality assurance uses digitalization to improve quality and reduce manual labor. Similarly, prior studies have pointed to the importance of green product developments to be a valuable investment and economically beneficial (Lee & Kim, 2011; Porter & Van der Linde, 1995; Steward & Conway, 1998).

Collaboration in the supply chain

The customer, one of the world's largest automotive manufacturer located in the US, was very important for the product development and a driver for the development (Guoyou et al., 2013). Previous studies have shown that customers provide valuable input to product development projects (Eslami & Lakemond, 2016; Öberg, 2010; Von Hippel, 1986). The customer allowed IndTool to get access and in-depth knowledge of their operations on the factory floor of assembly. IndTool has a long relationship with the customer, not only in the US, but globally as well. This study points to the importance of existing customer relationships, as IndTool got the idea for the product from meeting with the customer and spending time on the customer's shop floor and discussing sustainability aims. Hence, this is similar to previous studies, which has shown the importance of existing customer relationships in product development (Laage-Hellman et al., 2014).

Customers are very useful in the early phases of the product development (Blazevic & Lievens, 2008; Coviello & Joseph, 2012). In the early phases, the customer was a part of the idea generation for the product as well as providing IndTool with access and detailed insight into the quality assurance processes. The customer also had a list of requirements and desires for features of the new product. During the development project the customer was available for gathering information, specifying requirements and feedback on the product. Studies have shown that customers are important contributors in the end-phase of development projects (Kandemir et al., 2006; Kaulio, 1998). At the end-phase, the customer tested the product and was the first buyer of the product. Hence, the customer was involved throughout the project, and had different roles and contributions at different times in the development project. The customer also pushed for the introduction of the product to their global factories, which provided additional incentives for IndTool to develop a product that was to be available for the global market.

Suppliers have been identified as important collaboration partners in green product development (Hofmann et al., 2012; Sarkis et al., 2011). Two suppliers were involved in the project, one provided hardware and the other software. The relationships with the two suppliers were of a different nature, depending on their delivery into the product. The hardware supplier had clear specifications on what was to be delivered and thus this relationship was of a more distant nature with clear boundaries and design requirements with limited knowledge integration. This relationship can be described as being an arm's-length relationship where the supplier could quite easily be exchanged for a new supplier. The software supplier on the other hand had a relationship with IndTool that was described as a partnership (see e.g. Bonaccorsi & Lipparini, 1994; Ragatz et al., 1997). The development and integration of the software required extensive communication, collaboration and knowledge sharing between the two firms. Also, the customer's requirements and requests during the development provided additional in-put during the project that needed to be transferred to the supplier.

The relationships with the two suppliers were of a different nature, although they both contributed to the development project. The scope and nature of their contribution was an important factor for the choice of relationship (Rosell et al., 2017). The hardware supplier delivered according to quite clear specifications and could more easily be exchanged for another hardware supplier. The software supplier needed to understand the quality assurance processes at the customer in order to develop the software. For the software supplier to be able to provide suitable software, IndTool and the supplier needed close collaboration where the supplier understood IndTool's business as well as IndTool's customer's varying needs in the quality assurance. During the development project, the firms developed trust and increased both of their knowledge bases. The software supplier had a partnership with IndTool and could not easily be exchanged for another supplier without the project losing time and consequently adding cost to the project. However, IndTool was not locked-into the supplier (Handfield et al., 1999), as the software was not proprietary to that specific supplier. Hence, the software development could have been made by another expert supplier.

Internal collaboration

This project has involved a number of internal organizations within IndTool. In line with previous research, this study also points to the importance of internal coordination (Praest Knudsen & Bøtker Mortensen, 2011; Takeishi, 2001). First, the US organization was responsible for the development of DigiQual. In order to make sure that DigiQual was a suitable complement to the firm's main product, the hand-held tool, the US organization collaborated with the Swedish organization that is responsible for that tool. In addition, the Italian organization is running the development of the product that will replace DigiQual and are collaborating with the US organization regarding their experiences with DigiQual. Hence, there was geographically cross border collaborations within IndTool regarding this product. This study shows that geographical, technological and organizational proximity (Knoben & Oerlemans, 2006) influences intra-firm collaborations as well as inter-firm collaborations. There have been some internal struggles, as the US organization wanted the Italian organization to develop a global product, but they showed limited interest in that product from the start. Despite pushing the Italian organization as well as getting support from the Swedish headquarter, the US organization did not get any commitment for their product idea. Hence, they decided to develop the product by themselves for the national market.

The project involved collaborations across organizations and functions. It is shown that coordination within large firms which have specialized departments can be particularly challenging (Clark & Wheelwright, 1992). In this project, sales and marketing have been vital for the development of DigiQual through their good relationship with the customer. Purchasing has had an important role in managing the supplier relationships in this project, similar to studies of supplier involvement in product development (see e.g. Luzzini & Ronchi, 2011; Melander & Lakemond, 2014; Schiele, 2006). These functions have collaborated with R&D in order to develop DigiQual. Knowledge needed to be transferred between the functions, in particularly customer in-put needed to be described not only within IndTool, but also to the suppliers involved. A success factor for this project was the ability to create an understanding for the customer's processes and needs, as well as limitations for applying new technology in the automotive plant. Alignment between functions and across organizations has been challenging, but an important factor in order to succeed in the development of the new global product.

Conclusions

This paper illustrates the importance of customer and supplier involvement in green product development. This study shows that by understanding customers' operations, firms can develop green products using new digital technologies to replace manual operations. The study points to numerous green, operative and economic gains by applying digital solutions in an automotive plant. In addition, this study has pointed to a number of benefits from collaborating with customers in product development projects. The customer provided ideas, requirements and insight in the early phases of the project. During the development, the customer provided the firm with detailed insight into its quality assurance processes and helped deciding the features of the product. During the end-phase the customer provided feedback on the product and was the first buyer of the product (see e.g. Coviello & Joseph, 2012). By having existing relationships and much interaction with the customer, the firm was able to understand the potential of a new product for applications that were new to the firm. Hence, the good existing relationship was an enabler for the development project (Laage-Hellman et al., 2014). Other studies have shown that having a strong relationship with a customer is beneficial in development projects, as it increases efficiency and effectiveness of the development project (Lin & Huang, 2012). Close relationships facilitate knowledge transfer but may limit a broader range of knowledge. However, there are drawbacks to having close customer relationships. Studies point out that close relationships may harm innovativeness (Lin & Huang, 2012). In contrary, this study has shown that the close customer relationship was an enabler for the firm to enter a new product category and a new market. Other drawbacks found in the literature shows that collaborative development including customers that require a high level of interaction results in delays of the development process (Fang, 2008). However, no evidence of delays due to the customer was found in this study.

This study demonstrates two different approaches to involving suppliers in product development. One the one hand, a distant relationship, with the format of a traditional arm's length relationship with limited knowledge exchange, was created where the interface and design of the supplier's contribution was clear from the start. On the other hand, a close partnership with knowledge exchange during the project was developed with the supplier where the content of its contribution to the product could not be specified from the start. This is similar to much of recent literature on supplier involvement in product development (see e.g. Bengtsson et al., 2013; Johnsen, 2009). The supplier's contribution required the firms to build a shared understanding of the customer's processes and needs, which were transferred into the product.

This study confirms previous findings that cross-functional collaborations are important when involving external organizations in product development (Chadha, 2011; Takeishi, 2001). As this project involved both customer and suppliers, both sales and purchasing were important functions that needed to collaborate and share knowledge. As suggested by Curwen et al. (2013), it was important to have a clear goal and organizational capabilities. Functions within the firm that usually did not collaborate, namely sales and purchasing, had extensive communication and shared knowledge. As suggested by Wong (2013) the firm needed to develop knowledge management practices. Research often point to the importance of sharing knowledge with external partners (Rosell et al., 2017), but in this project, sharing knowledge within the firm was also important. For the future development, the firm shared knowledge it had gained from the development of DigiQual in the US to the Italian team that is developing the global quality assurance product. To access the customer's knowledge, sales was an enabling function, and very important for gathering information about what had been successful with DigiQual and which features that need further developments. Previous research has pointed out the green supply chain management focuses on external relationships in procurement, production, distribution, reverse logistics and packaging, as well as innovation in

these processes (Sarkis, 2003). This study adds to that stream of research by demonstrating how a firm involves both customers and suppliers for the development of sustainable quality assurance products.

This study has some limitations. Interviews have been made with the focal firm, individuals at the customer and the suppliers have not been interviewed due to limited access to these firms. A single case cannot be generalized. However, the aim of this study is not to provide statistical representativeness but to provide a rich description and understanding of a specific phenomenon. Future research could investigate how firms integrate and share knowledge with additional actors in the supply chain when developing sustainable solutions.

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Let and forget: a dilemmas perspective on contract governance in healthcare procurement

Laura Menzies
University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH, email: l.a.menzies@liverpool.ac.uk

Joanne Meehan
University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH, tel: +44 151 7953151, email: jomeehan@liverpool.ac.uk

Nicola Harris
University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH, email: nicola.harrisbt@btinternet.com

Abstract
There is a lack of contract management in healthcare procurement, despite pressure to cut costs and drive value. Through an in-depth case study, we reframe the 'problem' of the paucity of contract management as a decision dilemma to unpick the causes by exploring underlying attitudes of procurement. Resources focus on cost improvement plans; the role contract management plays in ensuring value is delivered is not recognised. A lack of consequence for not managing contracts dilutes the pressure to take responsibility. Attitudes become entrenched and the dilemma of where to focus resources loses its power to induce 'stop and think' behaviours.

Keywords: Healthcare, decision dilemmas, contract management

Introduction

Healthcare procurement covers purchasing of care (commissioning of healthcare providers) and purchasing for care covering the procurement of clinical and non-clinical goods and services (van Raaij, Schotanus and van der Valk, 2013). This research concerns the latter, purchasing for care. Procurement third-party spend in England on the National Health Service (NHS) totals over £27bn per annum, with goods and services (excluding pharmaceuticals, agency staff, estates and facilities management) accounting for £9bn per annum (Carter, 2016). The NHS is facing severe financial strain and the constraints are amplified as the demand for services have increased significantly over the past decade. To illustrate, latest figures show that in 2015/6, 46% more operations were conducted compared to 2005/6 (10.1 million up from 7.2 million), and hospital admissions rose by 28% to 16.3 million (NHS Digital, 2017). A government-commissioned report into the NHS in England cites a number of procurement problems that collectively cost an estimated £700million per annum; lack of value extracted from contracts, price variations, hidden costs, inefficiencies, poor compliance, lack of cost containment and poor inventory control (Carter, 2016). In this context, creating and extracting value through procurement becomes increasingly necessary (Meehan, Menzies and Michaelides, 2017).

The positive relationship between procurement and organisational performance is well documented (Sánchez-Rodríguez, Hemsworth and Martínez-Lorente, 2005, Schiele and McCue, 2006) and the potential for mainstream value contribution is clear (Cousins, Lawson and Squire, 2006, Ellram and Liu, 2002). Despite its strategic relevance as a policy tool,

public procurement is often not aligned to policy initiatives limiting its ability to drive broader societal value (Rolfstam, 2015). Procurement maturity demands a functionally integrated and coordinated activity that contributes to value and firm-level competitive advantage (Foerstl, Hartmann, Wynstra and Moser, 2013), covering structures, relationships, processes and systems (Van Weele, 2010). In the PSM field, gaps still exist in our knowledge of the role and importance of internal relationships, supplier development and corporate performance (Zimmermann and Foerstl, 2014). Contract management is a core activity linking value capture with internal and external relationships. Although not empirically validated, it has been suggested that contract management is classified in the Purchasing and Supply Management (PSM) literature as operational and functional, rather than strategic and organisational in nature (Matopoulos, Bell and Aktas, 2016).

Contracts are legal agreements that detail the work or transaction to be completed and the terms applicable, ranging from standard boilerplate clauses to highly customised, complex terms and outcomes (Schepker, Oh, Martynov and Poppo, 2014). Contract management is a continuous process that systematically ensures the delivery of agreed outcomes, KPIs, service levels, and contract compliance. Procurement, suppliers and other stakeholders work collaboratively through the contract life to ensure appropriate execution of deliverables and to analyse opportunities to improve and drive further value for all parties, increasing the potential for learning. The majority of extant studies focus on contract design and pre-purchase rather than contract delivery (Nullmeier, Wynstra and van Raaij, 2016). The pre-purchase stage of contract negotiation covers the operational terms of the agreement and can set out each party's value outcomes, relationship expectations, strategic intent, and organisational contributions. Many contracts, particularly those with key suppliers, or in high value/risk spend areas, can be complex and cover long timeframes. Value needs to be considered throughout the life of a contract (Pinnington, Meehan and Scanlon, 2016) as contract outcomes and expectations can change over time and in dynamic, complex environments. The importance of effective, value-focused contract management is often assumed, in practice and in the academic literature, yet in the UK's NHS the procurement teams lack engagement and influence over this part of the procurement cycle and contracts once let are often not actively managed by procurement (Meehan et al., 2017). This paper aims to explore why this is.

Contract management can eliminate some problems of opportunism in contracting (Brown and Potoski, 2003), and is important for effective governance (van der Valk, Sumo, Dul and Schroeder, 2016). Governance lacks a common definition, but in essence it relates to the agreed norms, rules and behaviour used to manage and guide how performance is sustained and how parties are held accountable for their actions. Two core concepts - steering and shared responsibilities – are implicit in governance. In considering contract management as an issue of governance, the lack of NHS procurement involvement raises important risks, as this can side-line the influencing of commercial issues of value, create gaps in accountability, and fail to create shared buy-in for broader issues involving consequences of economic power, market development, innovation, and network learning.

Literature review

Contract management

Contracts in business-to-business markets vary enormously. The academic literature around contracts is equally varied, although transaction cost economics (TCE) (Williamson, 1996) is the dominant conceptual framework adopted in many empirical studies (Schepker et al., 2014). TCE is useful as it provides parameters to manage ex-ante incentives in contracting

arrangements – dealing with forecasts and the potential for contracts to deliver particular outcomes, and ex-post governance – providing flexibility to manage performance based on actual metrics (Williamson, 1996). Although there are resource costs associated with contract management, these can be small in comparison to the savings achieved through effective supplier motivation (Turner and Simister, 2001). Effective management can counter issues of incomplete contracting (Brown and Potoski, 2003), which most contracts are, as many risks are unforeseen and rationality at the contract formation stage is bounded (Turner, 2004).

Empirical studies of contract management in the PSM literature are grounded in TCE as its constructs are deemed to 'explain' contracts (Schepker et al., 2014, Spina, Caniato, Luzzini and Ronchi, 2016). However, prior studies tend to largely focus on the mechanisms for contracting at the start of the process, rather than the on-going performance management of suppliers against the contractual agreements. Implicit in this view is a rational, economic view of markets and contracts that assume a 'good contract' will deliver agreed outcomes, a position that can mask behavioural or other factors involved in contract success. Moving to value outcomes is a major challenge in healthcare business-to-business relationships (Porter, 2010). The extant contract literature largely focuses on the assumption that the most efficient choices are made upfront and remain static, in contrast to value-based procurement, which is contextualised, temporal and multifaceted (Meehan et al., 2017). Approaches rooted in narrow cost and control ideologies can limit the potential for adopting longer term value based procurement strategies in healthcare (Meehan et al., 2017). Additional dimensions of contract management are needed (Schepker et al., 2014) to understand not just the outcomes within a contractual agreement, but to unpick and consider the longer term consequences of inter-organisational exchanges on other stakeholders from an ethical perspective (Piercy and Lane, 2007).

Governance and dilemmas

The potential for public procurement contracts to be used as a policy tool to achieve societal outcomes (Grandia and Meehan, 2017) and to add wider value to its environment (Telgen, Harland and Knight, 2007) is a common policy theme across Europe, USA, China and Brazil (Lember, Kattel and Kalvet, 2015). While compliance to effective legal regimes can promote accountability and value, contracts need to be effectively managed as the mere presence of a legal or regulatory framework does not guarantee success (Ibrahim, Bawole, Obuobisa-Darko, Abubakar and Kumasey, 2017). Market governance alone is not sufficient to drive changes in suppliers' commitments (Jiang, 2009).

The suggestion in the public procurement literature is that contracts should go beyond operational performance measurement to engage the supply chain in delivering broader policy outcomes over time. In this role, procurement requires maturity and strategic influence to balance supplier developments, internal relationships, and policy drivers. A buying organisation's involvement in contract management can co-determine supplier's performance as they become involved in service design and can reduce operational barriers (Nullmeier et al., 2016). Contractual governance is a term gaining attention in the inter-organisational literature (Benton and Maloni, 2005, Cao and Lumineau, 2015, Schepker et al., 2014, van der Valk et al., 2016), where attention is focused on the interplay of contractual and relational governance. Although these studies centre on governance, the studies are still often rooted in rational decision-making models, and can lack consideration of the complexities of competing demands, heterogeneous drivers and interests, political pressures, and power structures.

In etymological terms, governance refers to steering and guiding, not just control. At its most

abstract, conceptual level, governance is concerned with the delicate balance between the state and civil society (Stoker, 1998). In the broader governance literature complexity is taken as a core condition of the environment, particularly related to public sector governance (Schillemans and van Twist, 2016), and the need to reconcile diverse values is recognised (Chen, 2009). A number of ethical dilemmas emerge in the conceptualisation of governance (Stoker, 1998). Even at a basic, operational level, the question of which contracts should be managed raises dilemmas for procurement. The resource implications of managing all contracts actively (Brown and Potoski, 2003) could prevent this approach, particularly if many contracts are only transactional in nature, and resources are severely constrained, as in the NHS. A strategic account management strategy, whereby only key suppliers are managed is common in practice yet also raises ethical issues. Key NHS suppliers are defined in the latest Government-commissioned review (Carter, 2016) by levels of contract spend rather than a supplier's quality, criticality, innovation or value initiatives (Meehan et al., 2017), providing no incentive for suppliers to work collaboratively to reduce spend on contracts. Further, this approach favours the already powerful few, and if contract management improves a supplier's competitiveness, then it reduces the ability of smaller spend suppliers, typically SMEs, to compete and survive, distorting markets and power in the longer term (Piercy and Lane, 2007).

Tensions emerging when dealing with contract management are not discussed in the PSM literature. For instance, if suppliers, or other stakeholders are found not to be performing against agreed metrics or against the spirit of the contract, or if contract aggregation is considered to be leading to inequities in the supply chain, what should procurement do? Escalation and resolution procedures for operational issues might be contained within the contract documentation. What is less clear is who carries ownership, responsibility and accountability, and who leads this process, particularly in complex cases and for longer-term unintended consequences. Multiple, competing expectations of performance create conflicting legitimacies and dilemmas (Klingner, Nalbandian and Romzek, 2002). Public organisations have been shown to view contracting as a method to reduce responsibilities through passing accountability to suppliers (Brown and Potoski, 2003). Relationships can become increasingly charged in risk shifting activities (Benjamin, Nisim and Segev, 2015), exposing deeper dilemmas and debates on the responsibilities, political role, and ethical implications of contract governance steering by public procurement that goes beyond the provision of efficient and effective goods and services (Steinfeld, McCue and Prier, 2017).

To explore the lack of contract management in the NHS's purchasing for care (van Raaij et al., 2013), we utilise the concept of decision dilemmas (Bowen, 1987). Dilemmas relate to people's experience of having to make a choice between mutually exclusive alternatives, where each option creates emotional and personal concerns and challenges that are difficult to reconcile (Ozkaramanli, Desmet and E Özcan, 2016). Decision dilemma theories look at how people make decisions when the results and feedback on performance of actions are unclear. The difficult decisions people must make are usually not about isolated choices but the series of decisions that have consequences to an entire course of action (Staw, 1981). Emotional duality exists in dilemmas when the set of choices available each contain potential benefits and losses.

A diverse range of early psychology theories seeks to explain decision 'errors'. In the management literature, escalation of commitment (Drummond, 2014, Staw, 1976, Staw, 1981) has been a prominent development in the dilemmas research stream and describes how decision-makers' fail to disengage from a failing course of action, effectively throwing good

money after bad. Decision theories are useful but often do not capture the central nature of why the dilemma is created. This research builds on prior studies that identify a lack of contract management in NHS procurement (Meehan et al., 2017). In this research, we are interested in understanding the nature of dilemma in NHS procurement to address why there is a very low level of contract management, despite the significant pressure to find efficiencies and manage costs. Reframing the 'problem' of the lack of contract management as a decision dilemma enables our research to unpick the causes of the issue through exploring the underlying behaviours and attitudes. Our research questions, bounded by the empirical context of the NHS Trust examined, are:

RQ1: What are the resource priorities for NHS procurement?
RQ2: Do NHS procurement professionals see a broad potential of contract management?
RQ3: What are the levels of procurement maturity to manage contracts in an NHS Trust?

Methods

This research was conducted using a rich case study with one NHS Trust, in order to develop a deeper understanding of procurement professionals' attitudes towards contract management. In the UK, an NHS Trust is an independent legal entity that manages hospitals and operates under unique governance arrangements (NHS Choices, 2017). Attitudes are impacted by a multitude of factors such as culture, governance structure, internal and external perceptions of procurement, procurement maturity and leadership, which vary from Trust to Trust. A case study is valuable to explore context, dynamics and emerging issues in PSM (Dubois and Salmi, 2016). The case was selected in conjunction with a procurement development organisation. This particular Trust is excelling in many other aspects of procurement maturity but, crucially, contract management activities remain lacking.

Methods employed included both open interviews and observations. Previous research has attributed the paucity of contract management in the NHS to a lack of resources (Meehan et al., 2017), so the procurement team were observed to identify how their time is used and what activities are prioritised. The 'real-world' problem related to the lack of contract management was the starting point for the research, which drove the choice of a case method, and the various appropriate conceptual domains were iteratively explored as the research findings and analysis progressed (Brinberg and McGrath, 1985). Semi-structured and open interviews were conducted with senior procurement professionals from the team.

Participants selected had been at the Trust for 2years+ to enable comment on changing priorities and the culture, and all had roles sufficient to have an understanding of the strategic role of procurement. The researchers also spoke to internal end users including clinicians and non-clinical (e.g. IT) service managers to ascertain their role in ensuring suppliers were meeting contractual obligations. Observation notes were collected throughout and the semi-structured interviews were recorded and transcribed verbatim.

The data were coded and analysed thematically (see Table 1). Two of the researchers coded the data to achieve greater analytical richness (Eisenhardt, 1989). Coding was compared and discussed until consensus was reached, in order to improve the rigor of the analysis (Pemer and Skjølsvik, 2016). From the results, conflicts and accountability emerged as core issues experienced by NHS procurement staff. A serendipitous grounded approach explored conceptual explanations using dilemma theories and a governance lens to explain the lack of contract management. This approach was critical in our learning of the implications of the

original research problem, from academic and practitioner perspectives (Dubois and Salmi, 2016).

Findings and discussion

The results of our initial thematic analysis (see Table 1) centres on the current position of contract management and attitudes towards it from key stakeholders in the NHS trust. Our discussion centres on the three research questions to evaluate contract management in relation to concepts of decision dilemmas and governance to offer a new, rich insight in the complexity of contract management in the healthcare context.

Table 1: Stakeholders' views of contract management

Topic	Theme	Representative Data Examples
Procurement Activities	Cost improvements	*"Generally, I'd say maybe...70- 80% of time is cost improvement plan projects."* *"It's sort of time issues and when mainly our focus at the moment is CIP [Cost Improvement Plans], savings for the trust, it is difficult to dedicate so much time to contract manage all of the contracts awarded."* *"We do contract manage where we can but a lot of our time at the moment is cost improvement."* *"We are coming to the point, where there isn't much we haven't looked at, to be fair [under CIP]. We have pretty much looked at everything now. So it's difficult to come up with, now, projects that, erm, that is sort of viable and realistic."*
	Compliance	*"We are the experts to advise the people out there to say yes, we have a requirement, we've got to do x,y,z, to make a legally compliant procurement"* *"My personal experience is that compliance doesn't always go hand in hand with cost improvement because we can get much [emphasis] better savings going direct to our supplier."*
	Pre-award contract management	*"When I said light focus on contract management, that is, after we have initiated the contract. In the beginning side of the contract, procurement... we will do as much as we can to smooth the contract management process"* *"We try to manage as much as we can. We cover the information on that by anticipating some problems on the future.... It is about the contract management conflicts we can erase in most of the cases"*
	Post-award contract management	*"We don't contract manage the small value contracts. Large value ones, we will have regular contract management meetings with the provider".* *"In terms of contract management whenever we can do... delivered the project, it seems to be put to bed then because we don't have the time to go back and monitor it but I think more and more now [emphasis] we have to go back and monitor it because half of that delivery is ensuring that's realistic.*
Attitudes towards contract management	Aspiration	*"I think contract management is something that we have been trying to introduce on a more formal basis."* *"I'd say it's something that we are very aware that we need to do."* *"I think it's the aspiration. It's what we'd love to do, you know, we'd love to be able to properly manage all of the contracts that we have in the department."*
	Discomfort at lack of contract management	*"We have to think about the contract management side of things when we start the process. Some might...some might not..erm..and once we have the contract in place, then we only get limited time.... to manage a contract..."* *"Contract managing is really key to what we should [emphasis] be doing but again its just having that time because we are so under pressure at times where the amount of projects we've got to deliver because procurement is seen as a ...support function"*

	Time consuming	*"One of our buyers does contract manage those contracts that he awarded. He probably has quarterly meetings. There have been some performance issues so he has had to have a couple more meetings which has taken up a lot of his time, and a lot of work has come from that."* *"It is difficult to dedicate so much time to contract manage all of the contracts awarded. It really is something that we'd need a lot more time and resources to do really."*
Purchasing Triad	End users	*"We ask others to evaluate the quality. The experts; the end users, the clinicians, doctors....so they will evaluate, but we will carry them, contact them to say how we have to do it. So, they will do that and we will support and guide and mentor them to do it."* *"The clinicians are so busy, they wouldn't be able to spend enough time, to clearly track the requirement that is a problem in itself."* *"The ownership will sit with the end user in conjunction with procurement. They usually do the day to day management of the contract because we are not there on the shop floor, they will do the contract monitoring. We will come in when there is a problem, when there is confusion...a friction."* *"Our approach now is focussed upon the end users, making regular meetings with them as well, and that's key."*
	Poor supplier performance	*"We realised that the supplier had bitten off more than they could chew. Supply then started to really take a nose dive."* *"The supplier did not inform us that they could provide these pumps anymore. So, we had to very quickly put in another plan to ensure that we got them in from another supplier."*
	Distrust of suppliers	*"Our reps policy throughout the Trust, that a supplier isn't allowed to approach any clinician or anybody really in the trust without first coming through procurement".* *"Other trusts may have done tenders and got better prices. There's a whole host of reasons why but at least we have visibility on that now. So pricing now is transparent throughout the NHS... So suppliers are having to be a lot more transparent now in their prices. Which is great. For us."* *"These suppliers have been milking us for years when the pound has been really strong, and now they are saying it's got to this, and they are now saying we've got to put prices up. So it's hard really to have sympathy."*

Contract Management Activities

The most common barrier to contract management cited in the interviews was a perceived lack of resources to deal with the contracts and manage the ongoing actions arising. Participants predominantly defined resources in terms of capacity and staffing levels, rather than expertise and skills. Only limited contract management activities take place and are reserved for large contracts, typically valued in the £millions. For these contracts multidisciplinary teams comprising of procurement, finance, end users, and suppliers meet quarterly to discuss progress against contractual targets yet there was little evidence of a steering governance role to deliver wider value initiatives or health policy outcomes. Contract meetings are chaired by procurement, placing them firmly at the centre of the contract management activity, and providing potential opportunity for linking internal relationships management, supplier development, and organisational performance (Zimmermann and Foerstl, 2014).

An issue identified in the case is that the significant majority of contracts fall below the spend value that would warrant contract management. One participant clarified that despite

managing “hundreds” of contracts, they attended “no more than five” contract management meetings a month. The strategic management of contracts based purely on spend has been linked to ethical dilemmas (Piercy and Lane, 2007), particularly if the consequence of inequitable management leads to favouring the already powerful in a market. Although the contract management activity witnessed in this NHS Trust involved a range of different stakeholders, the focus tended towards operational KPI compliance and monitoring, rather than active steering towards longer-term value-based improvements to health outcomes, commercial agreements, or to analyse the consequences of contract arrangements on markets.

RQ1: What are the resource priorities in NHS procurement?

The analysis revealed the dominant priority for NHS procurement is to support end users to achieve their Cost Improvement Plans (CIP), set by finance, whilst also ensuring regulatory process compliance at the sourcing stage. Procurement performance is measured on its ability to support departments to meet CIP targets. Contract management is not perceived as a core activity in achieving this. Participants viewed resources in terms of limited capacity and low staffing levels rather than a broader consideration of resources (skills, capabilities, IT etc), and staff resources are focused on pre-award contract activities such as establishing key performance indicators, delivery schedules, etc. For contracts not actively managed, procurement pass the management responsibilities on to the end users, which is perhaps understandable given the clinical nature of some products, although this does not apply to all spend categories. There is a presumption made by procurement that the end users as “experts” will monitor whether the contract terms are being met, although critically this is not followed up by procurement, or even checked to see if these activities are completed. Given the high risk of some of the clinical products end users confirmed that they did actively assess product quality (if not necessarily contract performance), although for non-clinical areas the end users taking responsibility for this could not be identified.

There is an acknowledgement, at least by some procurement staff, of the resource pressures on end users that suggests expecting them to manage contracts, which sits outside of their official roles and responsibilities, is unrealistic. The lack of clear governance structures both inter-organisationally within contracts, and intra-organisationally across the contract management activity creates gaps of accountability. An interesting finding is how procurement positioned, and defended their lack of contract management. Their rationale is rooted in the belief that they sufficiently state the goals of the contract in early stages, which negates the need for procurement to be involved in post-award contract management activities. Procurement also refers to end-users as the experts to further shift responsibility and justify their own lack of contract management.

A clear and consistent message from the findings is that for procurement teams the activities related to securing cost reduction at the contract agreement stage are the priority. However, it was acknowledged frequently that the opportunities for savings are dwindling making CIP goals more difficult to achieve, suggesting a growing need for procurement to think more creatively. Procurement perceives freeing resource for contract management conflicts with their sourcing/contract negotiation priorities. Procurement do not recognise the full potential of contract management to reduce costs, certainly when compared to the potential cost reduction opportunities in contract negotiation. In terms of decision dilemmas, we trace the resultant lack of contract management to these conflicting priorities, as this is where the initial resource dilemma is rooted.

At the heart of the dilemma we find two conflicting paths. Procurement can: 1) use their

limited resource to drive for ex-ante CIP savings at the contract negotiation stage, set against 2) use their limited resource to work with suppliers in the longer term through contract management to deliver value potential and identify further improvement areas. This dilemma supports previous studies that confirm the resource implications of contract management (Brown and Potoski, 2003), but our findings importantly highlight the difficulties that people face in resolving this issue. The restricted resource in the NHS (NHS Digital, 2017) prevents them from merely increasing capacity to attend to both activities, heightening the dilemma.

The personal dilemma emerges because CIP savings are only recorded when contracts are agreed and there is no provision for recording additional value beyond the current annual accounting period. From a behavioural perspective, dilemmas often require a prioritisation between conflicting long term considerations and immediate concerns (Hoffman, Baumeister, Förster and Vohs, 2012). Evidence suggests that people weigh present events more heavily than those in the future (Frederick, Loewenstein and O'Donoghue, 2002). Social forces experienced in the environment shape and constrain decision dilemmas. Given the heavily pressurised NHS environment focused on saving money (Carter, 2016, Meehan et al., 2017), peoples' decision to prioritise sourcing in the short term at the expense of providing resource to manage contracts is perhaps understandable. However, this 'let and forget' approach is not compatible with value-based procurement, that moves from efficiency solely based on price, to broader, long term value measures based patient health outcomes achieved per pound spent (Porter and Teisberg, 2006). Short termism can have consequences that damage longer-term value-based approaches (Lindgreen and Wynstra, 2005), potentially further exacerbating the dilemma.

RQ2: Do NHS procurement professionals see a broad potential of contract management?
Our findings support the view suggested in the literature that contract management is predominantly viewed as operational rather than strategic (Matopoulos et al., 2016). Contract management and the broader relational concept of contract governance (Benton and Maloni, 2005, Cao and Lumineau, 2015, Schepker et al., 2014, van der Valk et al., 2016), however have strategic potential for assessing suppliers' performance and contract compliance, capturing agreed value, and identifying additional value sources. Our results show that there is a general recognition that contract management is recognised as important, but the language used by participants reveals that it is seen as a longer-term rather than an immediate priority.

The dilemma stemming from how to best utilise limited resource is indicative of conflicting legitimacies of competing expectations (Klingner et al., 2002). Decision dilemmas create mutually exclusive alternatives with challenges and choices that are difficult to reconcile, which are the hallmarks of a dilemma (Ozkaramanli et al., 2016). The emotional duality of a dilemma was evidenced in the apparent unease amongst participants when discussing the paucity of contract management in the NHS, manifested through broken sentences, unfinished justifications and hesitant responses. The majority of participants acknowledged that contract management is something they "should" be doing, however current resources and time pressures mean it is not possible to manage more than a few contracts each often in a cursory way. Participants were noticeably evasive around their choices, and the dilemmas experienced were palpable. The language used to describe the number of contract management meetings a month ["no more than five"] suggests that this activity is viewed as something to be minimised.

Interestingly, some contradictory rationales for not engaging with contract management emerged from the interviews. Some buyers failed to identify its potential and considered it to

be purely as a time-consuming drain on resources. Managing contracts creates more work as, once they are being managed, problems surface which then need dealing with. The consequences that impact a course of action, rather than the need to make standalone choices, increase the decision dilemma (Staw, 1981). Where contract management had taken place, poor supplier performance had been identified that had led to a significantly increased workload for the procurement team thus creating a reticence to engage in this activity in the future for fear of exaggerating resource pressures. This clearly misses the point and creates a vicious cycle of avoidance rather than problem elimination.

Participants did not seem to equate contract management with new value creation, nor with the ex-post value capture of agreed outputs. This is despite examples where contract management had uncovered poor supplier performance that increased operational costs and highlighted that pre-agreed value contributions were not being realised, which could then be addressed. Significant here, is that under the current procurement and finance regime only financial savings are recorded, and only at the point of contract award. This lack of life cycle consideration effectively reduced the motivation to manage contracts at all.

RQ3: What are the levels of procurement maturity to manage contracts in an NHS Trust?
When purchasing for care (van Raaij et al., 2013), there is a triad of stakeholders made up of procurement, end users (e.g. clinicians) and suppliers. The introduction of CIP targets imposed on Trust departments has led to an improvement in relationships between procurement and end users, as the interdependence between them has rebalanced. Procurement recognises the importance of good internal relationships and has invested time into strengthening links with end users and elevating its reputation as a support function. Although all stakeholders saw better relationships as a positive progression, procurement were still very much seen as supporting, rather than leading, even on areas of commercial importance. Where there are pockets of contract management on the major spend areas, procurement take a central role, although the sphere of influence tends to be delineated to the contractual boundaries, rather than a broader approach to drive policy initiatives or consider, and respond to, wider market consequences.

Internal relationships are seen as improving and healthy in the Trust, although relationships with suppliers were still problematic in many areas. Evidence of the poor relationship between procurement and suppliers is the frequency with which NHS suppliers circumvent procurement and go straight to end users to sell products or demonstrate innovations, despite policies to protect against this. Given the importance attached to gatekeeping relationships, it is interesting that no reporting to monitor these policy breaches take place, which in itself sends signals to suppliers of the lack of consequence.

There is a high level of distrust of suppliers evident in the data. It is therefore surprising that contract management is not given more of a priority when allocating resources. Contract management can be viewed as a control mechanism between buyers and suppliers, which is arguably a necessity in relationships with little trust (van der Valk et al., 2016). Participants refer to examples where suppliers have performed poorly against contracts but without contract management processes, it is difficult to establish how extensive this is, and even harder to enforce solutions. By focusing resources on pre-award contract management activities, procurement are identifying the ex-ante risks in contracts but then passing the accountability on to the supplier. This assumes suppliers will comply, despite evidence to the contrary. The examples provided of supplier non-performance against agreed contract criteria further add to the emotional element of the dilemma for procurement as it provides

contradictory evidence to their position that a good contract is sufficient. Our observations highlighted that rather than engage with, reflect on and discus the consequences and options that the dilemma created, all behaviours we would see in robust governance, procurement instead disengaged with the issue and amplified their defence of lack of contract management.

Despite the pressure to move to value-based procurement in the NHS (Meehan et al., 2017), participants stated that even if procurement were provided with additional resources, there is currently a lack of government-approved, quantifiable measures that could be used to measure supplier performance throughout the contract period. For example, if a supplier's product reduces length of stay or number of visits to a hospital, how much does this save the NHS? Without these measures, procurement are unable to quantify the long term value of choosing supplier x over supplier y. Participants used this rationale to challenge that contract management is less strategically important for ensuring value is realised as beyond quantitative delivery metrics, value within a contract is not calibrated. The dominant view was that 'demonstrating' value through contract management is not recognised, and not within their remit.

Conclusions and managerial implications

Our findings support previous studies that contract management was not a priority for NHS procurement (Meehan et al., 2017), despite the drive for long term savings (Carter, 2016). Cost reduction in NHS procurement is their top-down, highly visible and much-pressured target. Crucially however, there is limited, if any, evidence of actual cost reduction from contract negotiations in terms of budget changes and overall spend profile. Rather, an anticipated financial saving is recorded at this stage, regardless of the length of the contract, and it is deemed to have been achieved, despite no monitoring of spend against the contract.

We introduce a novel approach of decision dilemma theory to contract management to expose some central assumptions around procurement maturity. Procurement maturity as presented in the literature centres on the level of internal integration and contribution to organisational value or competitive advantage (Foerstl et al., 2013). Procurement in this case has good integration through CIP activities although their ability to create and capture value is limited, thereby adding to the dilemma. There is evidence that they can, and do, engage in contract management in large contracts, and take a central role in some of these. Maturity here, we argue is not necessarily only about their ability to 'do' contract management, it is around the ability to deal with the consequences of contract management. Operationally, the consequences could mean resolving complex and litigious issues of non-compliance and securing value capture. Strategically it might refer more to governance issues around market impacts, power inequities, health outcomes, and influencing social, health and economic policies. Maturity in this sense demands the resolution of resource-based decision dilemmas and appropriate governance across and within stakeholder relationships to provide accountability around the choices made.

Through this study we identify limited resource as an important dimension in decision dilemma theories. This is important contribution and extension to dilemma theories and it has a broader resonance for procurement maturity research and public procurement policy environments. Resource limitations and pressures create mutually exclusive alternatives with challenges and choices that are difficult to reconcile, which are hallmarks of a dilemma (Ozkaramanli et al., 2016). Without resource constraints, procurement could employ additional staff to increase contract management capacity. However, without this option, as is the case in many public organisations, the dilemma is heightened and ethical dualities

exposed.

From a governance perspective, complexity and the need to grapple with and reconcile diverse values (Chen, 2009) is taken as a core condition of the environment (Schillemans and van Twist, 2016). Contracts, particularly in economically and socially important industries like healthcare, are enormously consequential, beyond the bounded goods and services purchased. Healthcare procurement, particularly on the scale of the NHS, impacts markets, power dynamics, health outcomes, taxes, opportunity costs, and innovation. Public organisations in particular therefore have ethical obligations to ensure public contracts are effectively governed so that value agreed is captured, deliverables are actioned, and that the spirit of the contract is mutually beneficial, equitable and responsible. Governance in public procurement should however go beyond the operational boundaries of the contract and should consider the potential, the risks, the challenges, and the dilemmas of steering to deliver wider societal and health outcomes. The point here is not that this more strategic governance approach will provide the 'answers' to the dilemmas identified, in many instances it will create increasingly complex dilemmas and knock-on effects. The issue is that governance actively engages this critical debates about what organisations 'ought' to do, whether diverse values can be reconciled (Chen, 2009), and openly confronts complexity as a core condition (Schillemans and van Twist, 2016). Opening potentially difficult stakeholder dialogues and exploring dilemmas of short and long term decisions can provide valuable space for considered decision-making and provide accountability for actions (Meehan, Touboulic and Walker, 2016). Failure to actively acknowledge the dilemmas, or provide support to consider the choices and consequences risks a reliance on shifting accountability and risk back through the supply chain (Brown and Potoski, 2003), that further damage supply relationships and behaviours (Benjamin et al., 2015)

A final contribution of this research is exposing how procurement deal with the conflicting legitimacies of short and long term actions in a resource constrained environment. A critical conclusion from our research is counter-intuitive. Although dilemmas create cognitive dissonance and emotional tension for procurement staff, we argue that rather than eliminating dilemmas, we should encourage more dilemmas, with the caveat that these are supported by robust inter-organisational, and intra-organisational governance arrangements. Our premise is based on the potential for dilemmas to force reflection on the consequences of our actions and decisions. Time considerations feature heavily in decision dilemmas as the temporally based choices polarise acting against thinking. In a dilemma people are faced between acting now versus reflecting on future impacts of current behaviours. Dilemmas can behave as a 'slowing down' mechanism and can often force people to stop and think about their choices as they try to reconcile these polarities. Studies from psychology show that people look at their past experience to deal with dilemmas (Vera, Crossan, Rerup and Werner, 2014). An issue here for NHS procurement, is that a lack of experience in contract management coupled with the outward lack of consequence of not doing these activities dilutes the pressure for taking longer-term contract management responsibility. Over time, patterns of behaviour – in this case neglecting contract management and the associated long-term impacts - become entrenched and the dilemma loses its power to induce stop and think behaviours. Without the dilemma behaviours, procurement inevitably focuses on short-term gains reinforcing, normalising and legitimising actions, and further concealing longer-term losses. As procurement conceptually decouples their actions from consequences, it is unlikely that we will see a movement away from their let and forget approach to post-award contract management.

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The role of purchasing in the diffusion of sustainability in supply networks: a systematic literature review

Toloue Miandar
Politecnico di Milano, School of Management, Via Lambruschini 4/B - 20156 Milano Italy,
Tel: +39 02 2399 2819, Email: toloue.miandar@polimi.it

Thomas E. Johnsen
Politecnico di Milano, School of Management, Via Lambruschini 4/B - 20156 Milano Italy,
Tel: +39 02 2399 4058, Email: thomaserik.johnsen@polimi.it

Federico Caniato
Politecnico di Milano, School of Management, Via Lambruschini, 4/B - 20156 Milano Italy,
Tel. +39 02 2399 2801, Email: federico.caniato@polimi.it

Abstract
One of the most difficult challenges facing companies today is how to control and implement sustainability not only with direct first-tier suppliers but also how to extend or diffuse sustainability across entire supply networks. A growing body of research is dedicated to this challenge but the role of purchasing in sustainable supply network development remains under-researched. This paper provides a systematic literature review of the role of purchasing in the diffusion of sustainability in supply networks. We identified and analyzed 55 papers published in 11 peer-reviewed journals in the field of purchasing and supply management (PSM). Based on the review, the paper classifies strategies and practices for diffusing sustainability in supply networks, identifying the role of purchasing in the diffusion of sustainability in supply networks.

Keywords: Supply networks, sustainability, purchasing, diffusion

Introduction:
A growing amount of research on sustainability concerns purchasing and supply chain management, such as ethical sourcing (Preuss, 2009; Roberts, 2003), corporate social responsibility in the supply chain (Faisal, 2010; Maloni and Brown, 2006), socially responsible buying (Maignan et al., 2002; Park and Stoel, 2005) and green supply chains (Kainuma and Tawara, 2006; Mollenkopf et al., 2010). While significant progress has been made in these areas, it is important to make further advances and consolidate systemic issues that exist at the interface of sustainability, purchasing and supply (Linton et al., 2007; Miemczyk et al., 2012).

There is consensus in research that companies cannot tackle sustainability on their own as they rely extensively on their supply networks for the development, production and delivery of goods and services to customers (Andersen and Skjoett-Larsen, 2009; Krause et al., 2009). Addressing sustainability risk and implementing sustainability initiatives require network-wide changes involving coordinated action by actors across supply networks (Meqdadi et al., 2017). Companies are reportedly using different approaches - or strategies - in this endavour including, for example, supplier monitoring and development. However, the role of purchasing in this process remains an under-researched concept, despite being described as a key competence in the diffusion of sustainability in supply networks. In this

paper we report on a systematic literature review to develop a framework of possible strategies and specific practices within these for diffusing sustainability in supply networks (i.e. audits, surveying suppliers, requiring suppliers to comply with standards, supplier collaboration etc.) and to explicate the role of purchasing in these strategies and practices.

In this paper we seek to identify the state of the art of current research on diffusing sustainability in supply networks and on the particular challenges this poses for the field of purchasing and supply management (PSM). Therefore, the specific objectives of the paper: 1) to identify and classify strategies and practices for the diffusion of sustainability in supply networks and to explore the role of purchasing in this process, 2) to identify research gaps and needs for further development.

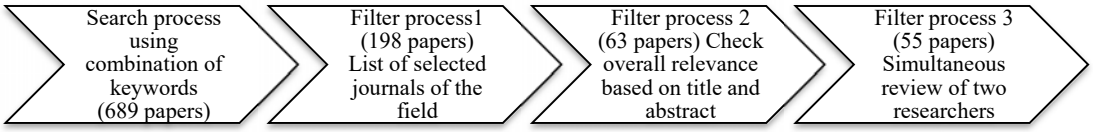
Methodology:

We have adopted a structured approach to the literature search and analysis. Following Tranfield et al. (2003), the key steps in a systematic review include the planning phase, the actually undertaking of the review, and reporting and dissemination. The aim of this method is to identify the current state of academic research and its key scientific contributions with regard to a defined research question. The review adopts a replicable, transparent and scientific process and follows certain steps that need to be clearly defined and described (e.g. Tranfield et al. 2003). This literature review systematically analyzes existing literature, examining publications on sustainable supply chains published in English, peer-reviewed journals, listed in the Scopus database. The literature review has been conducted in business, management and accounting journals. The keywords that were used for searching in article title, abstract and keywords fields were categorized into four groups:

- supply chain/supply network;
- sustainable/environment/social/CSR/responsible/green;
- extend/diffuse/spread/integrate;
- procurement/sourcing/purchasing.

Different combinations of these four groups of keywords have been used to search for literature published in the past 25 years; this first stage resulted in 690 papers. We then selected relevant research papers from a list of 32 journals generated on the basis of three major reviews of the field: general reviews of purchasing and supply management (Zsidisin et al., 2007; Spina et al., 2013) and sustainable PSM (Miemczyk et al., 2012); this filtering process reduced the list to 198 papers that were published in 20 journals. The titles of the papers within this initial sample together with the abstracts were then checked manually. Those papers with a title and abstract that was beyond the scope of this review were removed; papers that, were purely technical, as well as those concerning the consumer/marketing end of the supply chain, and did not cover social, environmental and sustainable issues were excluded. This reduced the list to 63 potentially relevant papers. Two researchers simultaneously reviewed these papers and ended up with 55 relevant papers (Figure 1) from 11 influential journals (Table 1) of the field that form the basis of our systematic literature review.

Figure 1 Systematic literature review process



The following table shows the journals in which we identified relevant research papers and

the number of relevant papers in every journal:

Table 1 Journals and number of papers identified for the final inclusion stage

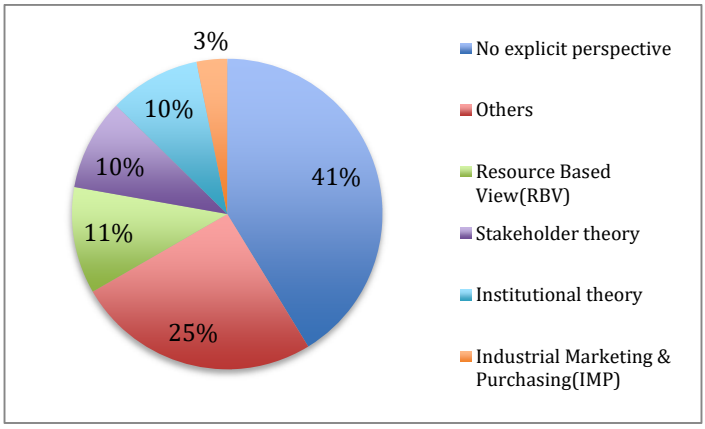
• *Journal of Cleaner Production*	14
• *Journal of Business Ethics*	9
• *Supply Chain Management: An International Journal*	8
• *Journal of Purchasing & Supply Management*	8
• *International Journal of Production Economics*	5
• *Journal of Operations Management*	3
• *Journal of Supply Chain Management*	3
• *International Journal of Operation & Production Management*	2
• *Industrial Marketing Management*	1
• *International Journal of Production Research*	1
• *Decision Sciences*	1

Data analysis and coding:
We built an Excel database that reflects the research framework and contains data regarding all 55 papers. This step was the starting point in conducting the analysis presented in the next section. Two researchers simultaneously and independently processed and coded majority of the papers, followed by regular meetings of three researchers to evaluate and finalize the codes. We commenced the analysis of the papers by examining theoretical background, dimensions of sustainability, methodology and level of analysis. Following this step, we analyzed and classified strategies and practices with a particular focus on the role of PSM.

Findings:
In the following section, we provide a general overview of the results of the analysis as a basis for understanding the research approaches that have been applied in the field.

Theoretical background
As a starting point, we analyzed the use of theoretical perspectives applied in extant research. As Figure 2 shows, 41% of articles are not grounded in any theories. The Resource-Based View (RBV) followed by an equal portion of papers based on Stakeholder Theory and Institutional Theory, are the most adopted theoretical perspectives, followed by Industrial Marketing and Purchasing (IMP) theory. For example, Arnold (2017) looks at how companies combine co-creation and relationship management approaches with respect to sustainability through a stakeholder perspective. Using RBV theory, Liu *et al*. (2016) seek to explain associations between supply chain capabilities and key elements of environmental management strategies. Based on institutional theory, Hoejmose *et al*. (2014) argue that the decision to implement green purchasing and supply chain practices and the choice between them is contingent upon institutional pressures (mimetic, normative and coercive). Adopting an IMP interaction approach, Meqdadi *et al*. (2017) seek to understand sustainability spread (or diffusion) as a change process that affects different supply network actors and the impact of power and trust on the spreading process. Other theories, such as transaction cost economics (TCE), resource dependence theory (RDT), are categorized here as 'others' as relatively few studies have applied these.

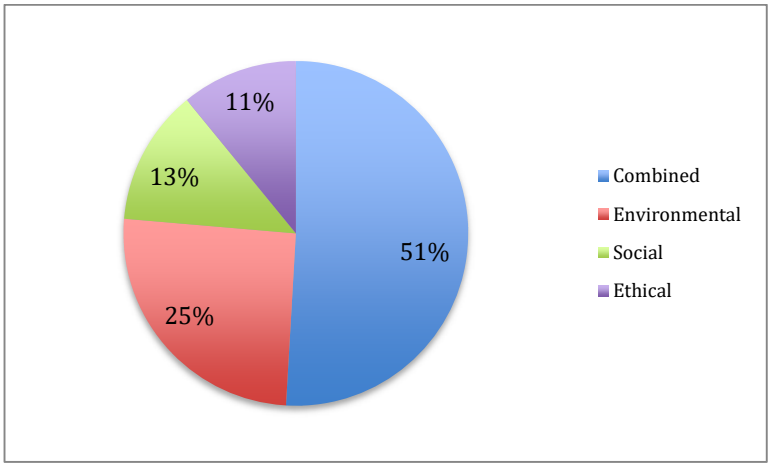
Figure 2 Proportion of papers based on theoretical background



Dimensions of sustainability

Sustainable PSM has been defined as " […] the consideration of environmental, social, ethical and economic issues in the management of the organization's external resources in such a way that the supply of all goods, services, capabilities and knowledge that are necessary for running, maintaining and managing the organization's primary and support activities provide value not only to the organization but also to society and the economy" (Miemczyk et al., 2012, 489). Thus, sustainable PSM takes in the three dimensions of environmental, social and economic sustainability but also separates out the ethical dimension. Often, research focuses purely on one or two of these dimensions: as Figure 3 reveals research with a focus on a combination of environmental and social aspects dominates the content of papers under study (43%), with the remaining papers focusing on environmental aspects only followed by ethical issues and social aspects only.

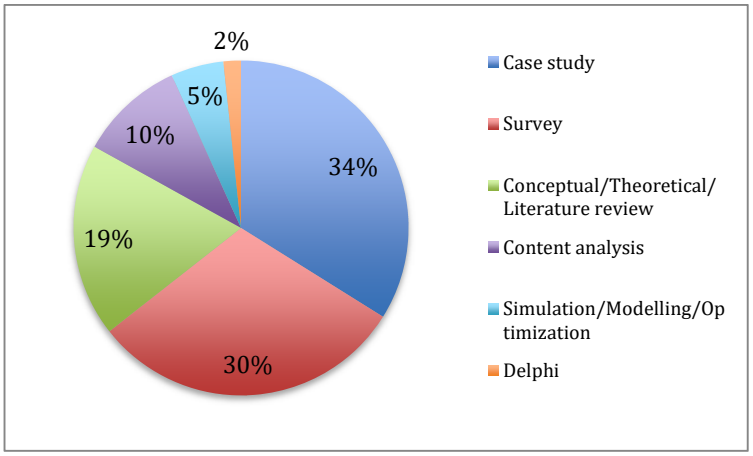
Figure 3 Proportion of papers across the different dimensions of sustainability



Research method and level of analysis

Figure 4 shows that the three most frequent methods are case studies (with 34% of papers), followed by surveys (30%) and conceptual studies including systematic literature reviews (19%). As identified by Spina *et al.* (2013), these three methods consistently proved to be the most popular in PSM literature. In terms of content analysis the contents under study were mostly published reports (CSR/sustainability reports) of the firms.

Figure 4 Proportion of papers based on the method of research

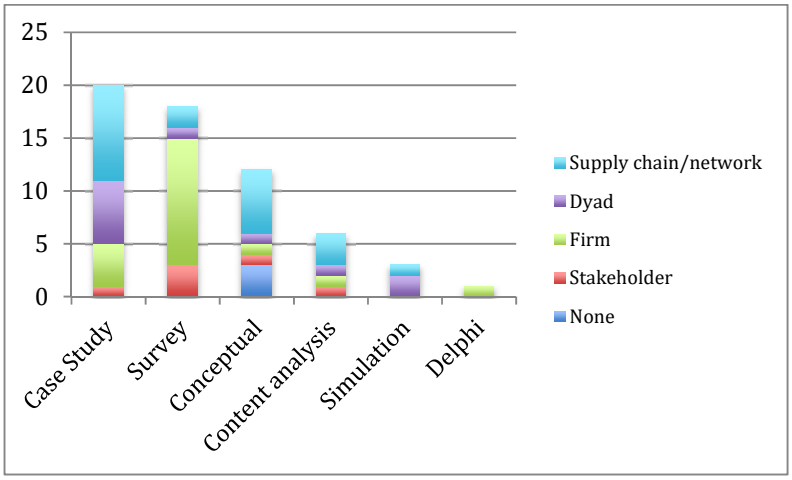


Furthermore, we analyze how studies have used different methods to examine different levels of analysis methods. We have identified four levels of analysis: firm level which concerns internal functions of the firm; dyad level which concerns internal functions of the focal firm and processes in interaction with immediate (first tier) suppliers; supply chain/network level of analysis which are processes beyond dyadic level also extending to multi-level involvement; stakeholder level of analysis which not only includes multiple levels of the supply chain/network, but also extends to other stakeholders (e.g. NGOs and public authorities). This analysis is important because diffusion of sustainability within supply networks can be done at different levels but different methods may be more or less able to fully uncover issues involved in this process. Analyzing methodological approaches, we are therefore able to get a clearer picture of which methods are used to research different levels of analysis. Figure 5 shows the relations between levels of analysis and applied methodologies, the proportions shown in the figure are based on each paper's claimed scope.

It is clear from the literature review that studies examining sustainability at the network level are rare. In reality, few studies adopt this wider view, and the terms "network" and "supply chain" are often used synonymously (Miemczyk et al., 2012). In defining the level of analysis we have therefore considered these two concepts together. The analysis shows that case studies are the most widely used method for supply chain/network level of analysis. The three in-depth case studies by Wilhelm *et al.* (2016) is one example of how case studies are used to reveal rich insights into supply chain sustainability, highlighting the importance of multi-tier supply chain involvement for achieving sustainability compliance along the supply chain.

Investigations and analyses of interdependencies among different actors are not typically included in dyadic or multi-tier focused analyses of sustainable PSM issues. This may explain the relative sparsity of survey-based studies that focus on supply chain/network issues with the exceptions of a few studies at the supply chain/network and dyadic level, which were based on survey methodology (Carter, 2000; Pérez and Gómez, 2015).

Figure 5 Different levels of analysis and applied methodologies



Overview of strategies and practices used in diffusion of sustainability in supply networks

The starting point for our framework development was working on purchasing strategies and practices (see Table 1). The structure of the table was inspired by Akhavan and Beckmann (2017) paper, which distinguishes between overall strategies and specific practices within these. Our framework provides a more comprehensive list of sustainable supply network strategies divided into six categories: (1) internal integration and governance; (2) sourcing (3) supplier monitoring (4) supplier development (5) stakeholder management (6) joint projects and co-creation. Based on our systematic review we are able to identify and categorize specific practices that have been investigated in the research that has considered PSM issues in sustainable supply network research.

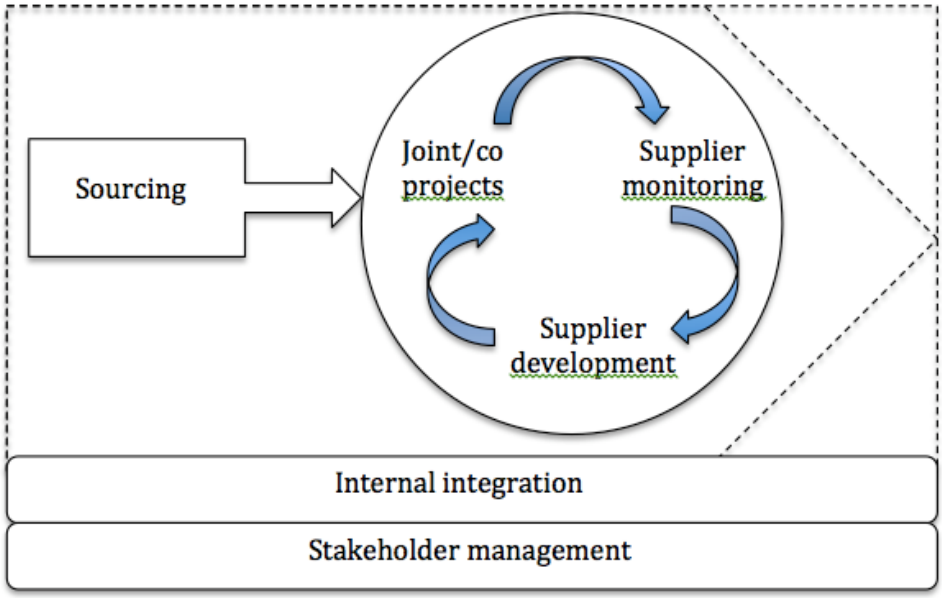
Table 1 Strategies and practices for the diffusion of sustainability in supply network

Internal integration and governance	• Internal training (Fritz et al., 2017; Teixeira et al., 2016; Bala et al., 2008) • Top management commitment (Akhavan and Beckmann, 2017; Knight et al., 2017; Griffis et al., 2014) • Employees ethical orientation (Griffis et al., 2014) • Defining, aligning and integration of sustainability goals (Liu et al., 2016; Akhavan and Beckmann, 2017; Knight et al., 2017; Large et al., 2013; Morali and Searc, 2013) • Data exchange (Fritz et al., 2017) • Assessment and application of green knowledge (Teixeira et al., 2016) • Permanent improvement of working conditions/enhancement of qualified employment (Large et al., 2013)
Sourcing	• Identification of the supplier requirements (Koplin et al., 2007) • Responsible buying strategy (Akhavan and Beckmann, 2017) • Sustainable sourcing strategies (Akhavan and Beckmann, 2017; Knight et al., 2017) • Responsible supplier selection (Thornton et al., 2013; Griffis et al., 2014) • Guidelines/codes of conduct/certifications/ standards/ ethical sourcing code (Teixeira et al., 2016; Van Bommel, 2011; Wilhelm et al., 2016; Morali and Searc, 2013; Preuss, 2009)

Supplier monitoring	• Supplier performance measurement (Sharma et al., 2017; Morali and Searcy, 2013) • Supplier audits (Wilhelm et al., 2016; Beske et al., 2014; Akhavan and Beckmann, 2017; Reuter et al., 2010) • Use of questionnaires and follow-up (Reuter et al., 2010) • Reporting (Morali and Searcy, 2013) • Supplier risk management (Van Bommel, 2011; Koplin et al., 2007; Schaltegger and Burritt, 2014; Beske et al., 2014; Cousins et al., 2004) • The role of power & trust in monitoring (Meqdadi et al., 2017)
Supplier development	• Supplier training (Akhavan and Beckmann, 2017; Hoejmose et al., 2014; Handfield et al., 1997) • Collaboration (Sharma et al., 2017; Fritz et al., 2017; Teixeira et al., 2016; Bala et al., 2008; Crespin-Mazet and Dontenwill, 2012; Morali and Searcy, 2013) • Incentives & rewards – Sanctions/filtering (Koplin et al., 2007; Akhavan and Beckmann, 2017) • The role of power & trust in development (Meqdadi et al., 2017)
External stakeholder management/interaction	• Relationship management/ stakeholder management (Arnold, 2017; Beske et al., 2014) • Co-creation (Arnold, 2017) • Governance/ policies (Morali and Searcy, 2013) • Collaboration with NGOs/non-business actors (Akhavan and Beckmann, 2017; Crespin-Mazet and Dontenwill, 2012)
Joint development projects	• Product design/green packaging/ eco design/ green design (Stindt, 2017; Teixeira et al., 2016; Liu et al., 2016) • Recycling/ down-cycling/ closed loop supply chains/ reverse logistics (Schaltegger and Burritt, 2014; Halldórsson and Svanberg, 2013) • Co-creation (Arnold, 2017)

In addition to the classification of strategies and practices shown in Table 1, we structure these into a process framework inspired by Johnsen *et al.* (2014) that depicts the processes involved in strategic sourcing, including the processes of selecting and approving new suppliers and the continuous cycle of monitoring, managing and improving these. Designed around the six categories of strategies that have been examined in extant research, Figure 6 provides a framework for how these relate to each other in terms of different ways in which companies can diffuse sustainability within supply networks in a structured fashion.

Figure 6. Framework for the diffusion process of sustainability in supply network



The role of the purchasing function

The next step in our review was to explicate the role of PSM in the diffusion of sustainability in supply networks. Or findings show that although procurement/purchasing managers have often been interviewed or surveyed, only a limited number of papers actually focus on the role of the purchasing function. For example, Teixeira *et al*. (2016) focuses on green purchasing, inclusion of environmental criteria in supplier selection and purchasing, but without a real consideration of the purchasing function. In Van Bommel's (2011) paper, purchasing is mentioned in the literature review but not incorporated or considered in the framework developed despite the focus on supply networks. Eltantawy *et al.* (2009) focus on supply management's ethical responsibility, reputation and performance impacts, however not with a focus on specific sustainability roles or competences. Other papers focus on specific contexts such as Large *et al.* (2013) who focus on the procurement of logistics services and sustainable development.

However, our analysis shows that there are very few studies that have specifically focused on the role of PSM in the diffusion of sustainability in supply networks. The focus of the paper by Koplin *et al.* (2007) is on incorporating sustainability into PSM, by integrating standards into supply policy and supply management; they state that the purchasing or sourcing function inside focal companies is the key actor to reach for, evaluate and monitor suppliers. Focusing on socially responsible supplier selection and supplier management (Ehrgott et al., 2011) firms are required to move beyond mere inspection of the offer terms they receive from emerging economy suppliers and to more intensively understand the business situation in the respective supply regions, which requires a cross-functional perspective and involvement.

Discussion and conclusion:

This paper set out to identify and classify strategies and practices for the diffusion of sustainability in supply networks and to explore the role of purchasing in this process, and to identify research gaps and needs for further development. Based on a systematic literature review we have examined studies across multiple levels of analysis and integrated multiple

fields of knowledge to show how research on sustainability in purchasing and supply is structured. In our selection of papers analyzed for the review, we ended up with a sample of 55 journal papers

We began the analysis of the field by examining the theories and methods used. Spina et al.'s (2013) comprehensive systematic literature review of PSM demonstrated that a relatively limited number of papers in the field made explicit reference to the use of theoretical perspectives, suggesting that the majority of papers in PSM are not grounded in consolidated theories. Focusing on sustainable (rather than general) PSM, Johnsen et al. (2017) recently showed that the sustainable PSM research in fact increasingly builds on theory to aid analysis of empirical results and to build new theory. They also demonstrate a growing trend whereby authors in the field make explicit statements about their use of theory, which is supported by others although as Chicksand et al. (2012) and Johnsen et al. (2017) both point out it is problematic to define what constitutes theory and that 'theory' is often used very loosely. Our results, based on a sample of sustainable PSM literature, would appear to support these recent results, as our analysis indicates that the majority of the papers do have explicit theoretical perspectives. Nevertheless, we found that 41% have no explicit theoretical perspectives, which is a higher proportion than Johnsen et al. (2017). Confirming the results of Johnsen et al. (2017), we also find RBV, stakeholder and institutional theories to be dominant whereas TCE – in contrast with its popularity in general PSM research (Spina et al., 2013) – is hardly ever adopted.

The use of theoretical perspectives ties in with the level of analysis and research methods applied. The topic of our systematic literature review is diffusion of sustainability within supply networks so about chains and networks. Our analysis shows that whereas PSM in the past dealt mostly with first tier suppliers, more recently there is a perceived need to look beyond the immediate suppliers relationships to understand and gain visibility over the extended multi-tier supply chain and this is reflected in research (Wilhelm et al., 2016). Some authors have argued that sustainability needs to be understood from an even higher level of analysis (Johnsen et al. 2017); this level is typically referred to as network or stakeholder analysis. The advantage, but also the challenge of adopting this level of analysis, is that the stakeholders in sustainable development are many and varied. The achievement of sustainability involves multiple inter-connected actors who are likely to have different ambitions and objectives, and the friction among these network actors may be critical (Araujo and Harrison, 2002). Our review shows that the majority of papers focus on firm or dyadic level of analysis, followed by the supply chain/network level and few stakeholder analyses to date. In general, the scarcity of empirical research at the network level highlights many opportunities for research, despite the methodological challenges. Case studies may be required to capture the complexities of supply chains and networks and on the basis of our analysis of research methods and theories we observe the recent use of in-depth rich case studies for exactly this purpose.

In this paper, we have focused specifically on the role of PSM in diffusing sustainability into supply networks. We argue that in order to be able to diffuse sustainability in supply networks, research needs to study the role and importance of PSM and its cross-functional interaction with and involvement of different functions. Our analysis shows a clear gap in current research on these questions creating a need to investigate how different functions are involved both from the managerial/implementation and research point of view.

A major contribution of this paper is the highlighting of gaps in the way that sustainability in purchasing and supply activities has been researched. In relation to specific purchasing strategies and practices, we found that the majority of research focuses on the selection and evaluation process of suppliers. However, few papers actually address other purchasing strategies, such as supplier development. Even fewer deal with issues relating to

sustainability implementation through co-creation and collaboration with other actors and stakeholders engagement. There is a need to understand issues related to strategies and practices, especially across the extended supply network where the risks involved may be considerable. Furthermore, on the network level, researchers are not asking how stakeholders are involved in organizational processes of decision making, i.e. in setting clear objectives or evaluating suppliers. Also, as companies are increasingly using third parties such as Sedex or EcoVadis to help identify "at risk" suppliers (Miemczyk et al., 2012) researchers need to examine the interaction with such new supply chain or network actors.

Future avenues of research:

One possible future direction of research is related to the fact that majority of research focuses on one or few of the six clusters that we have presented in our framework in other words researchers do not appear to be taking the whole diffusion of sustainability as a process into consideration rather than silos way of thinking towards this diffusion process. Following our proposed framework, future research could address the question of WHAT should be done in order to be able to diffuse sustainability in the supply chain/network. From the very first stage of sourcing to supplier monitoring, development and joint projects, the purchasing function would seem to be a key actor so research with focus on the role of purchasing could address the question of WHO can take the lead towards the diffusion of sustainability in supply chain/network.

Other avenues of future research center around 1) further in-depth case studies required to capture the complexities of supply network level of analysis and stakeholder issues, 2) cross-functional perspective and involvement of different functions required in order to investigate the level of involvement of every individual function but also in terms of interaction of different functions in the diffusion of sustainability, 3) broadening the coverage of purchasing strategies and practices required to diffuse sustainability throughout all stages of the process in order to be able to implement sustainability in the supply network, 4) taking a closer look at the role of purchasing function as the main actor in setting and implementing sustainable strategies and practices.

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Complex healthcare procurement responses within temporal complexity falling on "deaf-ears": An audiology case study.

Dr Roula Michaelides*, University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH, tel: +44 151 7953151, email: roulam@liverpool.ac.uk

Dr Laura Menzies, University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH, tel: +44 151 7953151, email: l.a.menzies@liverpool.ac.uk

Dr Joanne Meehan, University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH, tel: +44 151 7953151, email: jomeehan@liverpool.ac.uk

Mr Mike Ludbrook, Value Time Consulting Ltd, mikeludbrook@neilfuller.com

***Corresponding author**

Keywords: complex healthcare procurement, temporal complexity

Abstract:
Delivering better value healthcare has been a key political aspiration of UK governments over the past 20 years. However the escalating £671m deficit that was reported for the UK National Healthcare System (NHS) for 2015 is an astounding paradox signaling a failing of government policy. The government responses to the NHS spiraling deficit, is one of increasing procurement control- both in terms of contractual control and governance mechanisms, with a clear £1 billion savings targeted at procurement improvement (Carter, 2015). This paper argues that short-termism approaches focused on healthcare productivity and reductionist cost efficiency-savings in purchasing environments such as the NHS, do not foster contemporary notions of collaborative innovation and value-based approaches. To support this we have studied over the last two and a half years, procurement practices across a cluster of 36 procurement departments and four Healthcare Trusts in the UK's NHS and across a variety of large and small-medium size NHS suppliers. In this paper however we are specifically reporting on a case study involving one Healthcare Trust where a different approach in managing purchasing was introduced to address issues of temporal complexity. This paper proposes that challenges around value-based procurement in the NHS are mainly complexity issues and using the theoretical assumptions of complexity theory we focus at the particular impact of temporal complexity and the responses to this as we contribute to collaborative health service ecosystem practices.

Introduction

The NHS as a viable care system forms a unanimous area of heightened concern amongst all socio-demographic groups in the UK (18-34 years old; 35-55 years old and 55+) with a staggering 61%-68% identifying the NHS as the most import issue facing modern Britain (IPSOS-MORI_5-15 May 2017, 2017). With ever increasing demands, spiraling deficits and the Brexit uncertainty on resource availability, the NHS ability to deliver care to the UK population is more than ever questioned. The founding aims of the NHS which are to provide equitable, comprehensive, high quality healthcare for free when patients use it—have not altered since its launch 69 years ago yet its ability to respond within turbulent times is not sustainable (Iacobucci, 2017).

The government response to the severe funding pressures on the NHS has been a funding slow-down from 2010/11, which prompted the relentless push for procurement to achieve price reductions. The drive for procurement to achieve target cuts (Hood 1991) without taking into account the institutional characteristics of the NHS, has fueled the perception that healthcare procurement professionals are mainly driven to cut costs and enforce process compliance. The financial control constraints therefore imposed from 2010/11 appear to have taken some time to impact on patient care (TheKingsFund, 2017) and many of the cuts that have been made are accumulating problems for the future. Unfortunately, this reductionist focus does not foster contemporary perceptions of collaborative innovation and service provision which has consequently led to an inability to operationalize value-based approaches into workable procurement processes (Meehan, Menzies and Michaelides, 2016).
Different perceptions of value within the complex health procurement ecosystem make value difficult to be measured with the currently available metrics across product and patient pathways.
The NHS as an organization demonstrates both structural complexity across its multiple trusts, departments and services as well as behavioral complexity, evidenced through the multitude of stakeholders with conflicting practices and logic. Indeed, the behavioral deficiency and non-existence of an overall decision maker makes it more difficult to optimize the impact of value-based procurement.

In addition the short-term structured budgets and fluctuating annual saving targets introduce the time element of temporal complexity that has a profound impact on the whole procurement lifecycle and collaborative ties with suppliers as they detract from ownership of cost and value considerations. It is this particular perspective of temporal complexity that this research seeks to address.

Governments have systematically failed to address the NHS as a complex social setting and their responses to the NHS diverse and competing institutional demands have been imposing *control* and *contractual governance* to regulate spiraling costs and collaborative interactions in multi-player arrangements (Roehrich and Lewis, 2014). It is a fair conclusion that these government responses of tight institutional control to healthcare procurement complexity has been unsuccessful as the NHS deficit is still growing as well as public concern escalating (IPSOS-MORI_5-15 May 2017, 2017). Public health purchasing strategies for managing product portfolio complexity and facilitating innovation is mostly focused on traditional process-based contexts of contractual, compliance-centred mechanisms (Meehan, Menzies and Michaelides, 2016). This says little about how purchasing strategies can be structured to facilitate collaborative innovation with suppliers. The notion of value across patient pathways and the inter-relationships of cost and clinical and commercial value across product and patient pathways remain challenging and complex.
So, suppliers navigate the complexity of healthcare structures by forging relationships directly with clinicians and users, frequently by-passing the procurement department. Which in turn perpetuates a *symbolic compliance* from actual practice as stakeholders by-pass the health procurement specialists – who are seen as the organizational control agents - thus undermining the exchange of knowledge as social capital forms the cornerstone of value-based thinking. So it follows that the expert knowledge that can be provided by procurement specialists (raging from commercial risk assessment and management, cost reporting and managing, contract compliance and regulatory standards assurance to embedding learning across contracts and trusts) is minimally realized within the NHS organisation. The behavioral complexity suggests that pockets of good practice are person-centric, and result from individual good relationships internally and externally, rather than being indicative of a culture focused on driving value,

improvement, learning and knowledge sharing.

In particular this paper reports on responses to procurement complexity within the specific context of temporal complexity in a case study.
We therefore address the following research question:

RQ1: What are the driving forces that create temporal complexity in procuring product portfolios?

Perspectives from complex adaptive systems theory (CAS) provide a lens to understand the overall effect that individual contractual arrangements across a cluster of 36 NHS procurement departments within four health trusts can have upon the public healthcare structure itself. Towards this, procurement activities were studied through focus groups and interviews with procurement staff, clinicians, health professionals and suppliers. Then a focused study targeting one of the above clusters was selected to identify the temporal complexity perceptions and it is these findings we will be reporting here. In the next section a brief review of the elements of a CAS system within the healthcare procurement are presented and also temporal complexity within public procurement systems is introduced.
Following this the methodological considerations and design for the deductive qualitative approach are discussed and the empirical case setting is described. The findings are then discussed in the light of the contextual background of temporal complexity in public procurement in the NHS.

Public Procurement as Complex Adaptive Systems and Temporal Complexity

In the last two decades an increasing number of researchers and professionals have started to use complexity science to better understand organizations. According to complexity theory, a complex system (CS) is a setting demonstrating a large number of interacting elements thus making it difficult to surmise that the properties of the entire system is based on the properties of its constituent elements (Simon,1962). This is mainly due to the way these elements interact interdependently and the strength of their interactions that changes with time (Ethiraj and Levinthal, 2004).
Complex adaptive systems (CAS), a branch of complexity theory, is useful to model complexity within a system. According to Anderson (1999) the difference between a complex system (CS) and a complex adaptive system (CAS) is that in CS entities (constituent elements) follow fixed rules whereas in CAS entities adapt. This ability to adapt is of particular interest as it infers that complex adaptive systems learn by creating new decision rules, structures and behaviours (McCarthy et al , 2006).
Sweeny (2002) articulates the benefits of using complexity theory as a study lens for the NHS as a complex system by suggesting that "complexity has the huge appeal of offering fresh potential for understanding systems, whether these 'systems' are patients, consultations, public health, organisations such as Primary Care Trusts (PCTs), or the whole National Health System (NHS)". Some recent research studies have specifically approached healthcare procurement using complexity as a theoretical approach to study contractual governance in managing complex procurement (Roehrich and Lewis, 2014) and purchasing structural and decisional complexity (Sanderson et al, 2015).
Complexity theory is the ideal lens to study procurement within healthcare because there are multi-level interactions and negotiations between stakeholders which are grounded in social

practice. Elements of CAS include self-organisation, emergence, multiple interconnections and systemic co-evolution with feedback loops (McCarthy et al. ,2006).
Self-organisation is evidenced in CAS as multiple stakeholders, agents interact and connect new behavior model patterns appear, and networks self-organise. These interactions cannot be completely understood or imposed from outside of the system (Anderson, 1999). Within the NHS procurement context patterns of behaviors across the procurement clusters and the Health Trusts show self-organising tendencies as they decouple symbolic compliance to actual practices (Bromley & Powell, 2012, p. 23).
Emergence is evidenced in a CAS setting with multiple changes happening as stakeholders/ agents enter, exit or transform within the organisation. Within the NHS procurement context individuals change and adjust during transformational times.
Another key characteristic of CAS are the multiple interconnections formed by multiple agents interacting, acting and making decisions that may affect related individuals and systems (Mitleton-Kelly, 2003). Within the complex healthcare procurement context multiple NHS agents coexist and interact widely within the structure and learn from each other within the organization and across the supply chain and patient pathway. Finally co-evolution and feedback loops are evidenced in CAS where striving for fitness drives adaptation between the states of equilibrium with varying output feedback loops. Within the healthcare procurement context where there are multiple and competing rules and practices, the inflexible procurement processes stifle co-evolutionary adaptation and innovation whilst collaborative, open interaction may enable innovation and encourage value-based approaches.

The elements of CAS mentioned above, such as self-organisation; emergence; multiple interactions and systemic adaptation with feedback loops (McCarthy et al. ,2006), are illustrated below (Figure 1). Figure 1 depicts in a visual way the interdependencies of these elements from the micro-perspective of the individual agent to the macro organizational level of a complex system across time. Indeed it is the temporal complexity that features high and is the focus of interest in this study.

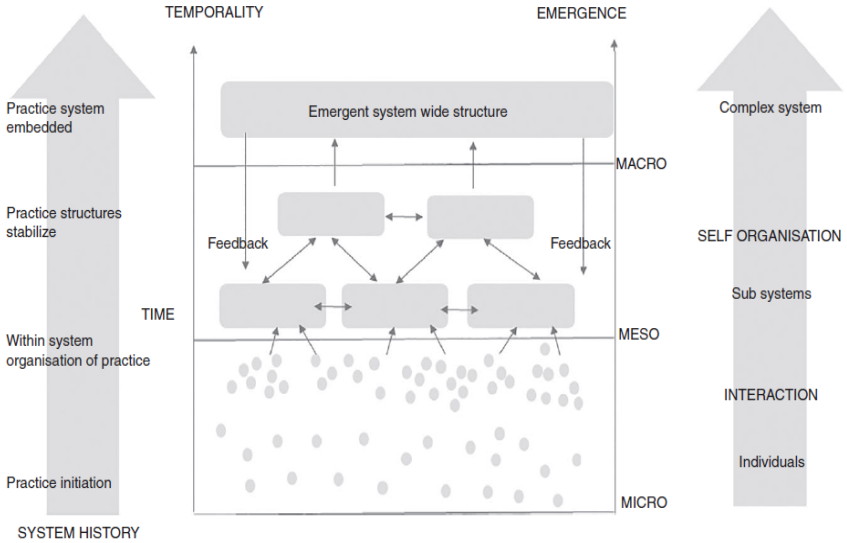

Figure 1. CAS model elements, *Source:* Chandler, et al (2016; p16)

In this paper we have adopted temporal complexity from Hassard (1996) who suggest that organisations need to understand and attempt to manage the impact of operational uncertainties when timing their activities. In operations management (OM) research time is often seen as one-dimensional, with much effort going into squeezing time to develop new products, improve

services, move resources, ship products and improve productivity by exploiting clock-time (Klassen and Halmohammad, 2017). So time exploitation (where less is more) in OM has a strong focus on process improvement, through compression of time but also through reduction of disruption which have led to complex scheduling and coordinating diverse activities (Klassen and Halmohammad, 2017). In the context of purchasing, time is also clearly defined as a key purchasing performance indicator, along with Cost; Quality; Flexibility; Innovation and Sustainability (Caniato et al., 2012).

In purchasing activities in the NHS, temporal complexities and uncertainties would include: the constant changes and dynamic nature of national health organisations (Paina and Peters, 2012); reconfiguration of healthcare procurement (Bals et al, 2018) with the introduction of new regulations, policies, frameworks, targets challenges; multiple interactions and power variances among clinical professionals, medical suppliers and purchasing professionals; conflicting priorities among various stakeholders; fluctuating procurement processes and lack of transparency in decision-making (Juha and Pentii, 2008).

Research Methodology- Empirical setting

Recent research studies have used complexity as a theoretical lens to study healthcare procurement from different perspectives such as: contractual governance in managing complex procurement (Roehrich and Lewis, 2014) and supply chain purchasing structural and decisional complexity (Sanderson et al, 2015).
This longitudinal study unravelled in two phases. In the first phase we examined interactions between healthcare agents involved in procurement across a cluster of 36 NHS procurement departments, four UK NHS trusts, and sought to identify how temporal complexity influences the structural characteristics of the healthcare environment. A longitudinal deductive, qualitative approach was used to study the purchasing environment and practices in the NHS. The research questions were drawn from gaps in existing literature and a number of interviews conducted using a interview protocol that was developed to assist us answering the research questions. In the first phase of our research study data collection involved interviewing, observation and focus groups consisting of purchasing managers within four hospital trusts, healthcare suppliers (multinationals and SMEs) who design and manufacture clinical products, clinicians who participate in the innovation cycle of products design (orthopaedic) from a user-perspective and clinical support staff. The analysis proceeded in several steps and lasted two and half years.
The practitioner feedback ensured that our qualitative study was firmly embedded in the procurement reality of the NHS so we could understand agent interactions, their interdependencies and the motivations behind these.

Following the first phase of our longitudinal analysis of four hospital trusts and 36 procurement departments we confirmed that indeed healthcare procurement exhibits the emergence, dynamicity, and interdependencies of a complex adaptive system. The findings of the first phase have been reported previously (Michaelides, Meehan and Menzies, 2016). We then sought to initiate the second phase, involving a specific case study to look at the temporal complexity aspects of procurement and to look at different value-based responses in managing purchasing to address issues of temporal complexity. Guided by Eisenhardt 1989, Yin, 1994, Gephart 2004 we selected a case study methodology as more appropriate to gain an in-depth understanding of the dynamics present in this particular NHS health trust setting and to

specifically study the key elements and their interactions. (Eisenhardt 1989, Yin, 1994, Gephart 2004).

The case presented here is based in one large health trust in the Northwest of the UK with the Procurement Department and a very large Audiology Center that sees approximately 2500 new patients a year. This particular Audiology Center was selected due to large volume of patients, the large variety of hearing-aid products procured but most importantly due to the temporal profile of "life-long" patients with most visiting at least twice a year for new supplies and maintenance of their hearing-aids. Which means that the clinical staff spend more time on old patients rather than new and this was highlighted as a key challenge.

The themes we sought to understand across the NHS Trust involved in the case study were:

- Temporal realities, key challenges and operating constraints and interdependencies in public healthcare procurement and competitive issues.
- Local perceptions of the key problems and trade-offs associated with temporal complexity

The fieldwork activities conducted in this study are summarised in Table 1.

Table 1: Chronology of the case study longitudinal fieldwork activities

Data activity instance	**Date**	**Activity Setting**	**Activity Focus**	**Affiliation**
Focus group	May 2016	NW Medium sized Hospital Trust : Large Audiology Department	Identification of temporal complexity perspectives across clinical, procurement and suppliers introduction of value-based procurement measures	Regional NHS Procurement Leader -1, Trust Procurement Manager -1, Audiology clinical head -1, Audiology department clinical staff -4, supplier -1, University researchers -1
Observation and service mapping	June 2016	NW Medium sized Hospital Trust : Large Audiology Department	Service blueprinting and value-based scenarios	Universityresearchers-2, Procurement Leader -1, Trust Procurement Manager -1, Audiology Department clinical staff -3, Audiology administrative support-2
Focus group	July 2016	NW Medium sized Hospital Trust : Large Audiology Department	Temporal Complexity responses: - through service blueprinting identify processes where temporal complexity manifests itself and run value-based scenarios	Regional NHS Procurement Leader -1, Trust Procurement Manager -1, Audiology Department clinical head -1, supplier -1, University researcher-1

Focus Group	September 2017	3 NW UK Trusts and cluster of procurement departments	Consolidate case findings and validate these across 3 more Health trusts	Regional NHS Procurement Leads -2, Trust Procurement Manager-1, Audiology Department staff -12, University researcher -1

The findings from the three focus groups and the observation activities involving a total of 39 NHS procurement, clinical staff as well as suppliers including regional NHS trusts procurement leaders and 2 procurement officers are reported here.

Case findings- Discussion

In the first focus group we sought to understand and identify the temporal complexity perspectives of healthcare provision and procurement and that drove our qualitative analysis protocol. During this first focus group it became obvious that within temporal realities of work there were objective and subjective dimensions of temporal complexity. The subjective dimensions were mainly around how staff perceive and experience time complexity in their care provision and their processes whilst objective dimensions were around cost targets. Once these temporal dimensions were identified the focus group participants were then asked to propose measures they would use to cope with these temporal complexities and increase value to patients in the form of "wouldn't it be great to…". The participant responses were scrutinised by panel of members including the regional procurement leaders, clinicians and topic audiology specialists.

The qualitative findings are summarized in Table 2.

Following the first focus group we sought to observe in action the temporal realities, key challenges and operating constraints in the case Hospital Trust and the large Audiology center. The observation period spanned across 2 weeks and service blueprinting was employed as this is a highly effective technique to map processes for service innovation through a customer experience design as well as running scenarios in value improving service(Bitner, Ostrom and Morgan, 2008).

Table 2: Temporal realities of the Audiology case study (focus group 1)

Staff affiliation	Staff experience of temporal complexity	Exemplary evidence	Value responses: Wouldn't it be great if ….
Clinical staff	- Most time spent on non-value maintenance work. For example currently the department schedules 13000 re-tubing appointments annually. - No time to run patient classes, demanded by patients, to demonstrate straightforward hearing-aids maintenance such as re-tubing. - The process of referrals by the GP is laborious and time-consuming thus delaying many appointments.	**"***my team would prefer to carry out more high-value work, and this could be achieved through giving more responsibility to the patients to re-fit their own tubes"*	• Offering the Receiver-in-Canal (RIC) hearing aids (a more expensive product) o Audiology would like to be able to offer literature, podcasts and a free kit (including tubing threader etc) for suitable patients to undertake their own hearing aid maintenance. This would lead to a reduction in appointments. This would have a slow and long-term impact. • Working in the Community o Direct referrals to save GP time. This would have a quick impact and is easy to implement.
Procurement	- Most time spent on compliance pre-contract tasks - A plateau price has been reached in most price negotiations with suppliers- new innovations in pricing to be investigated. - Increased pressure on suppliers could lead to suppliers leaving the market, providing poor products, with less competition at a higher price. - No time to manage contracts post-award - Cost saving annual targets driving "short-termism"	- *"we want to implement new ways of working but we are limited in capacity to do so due to the demands of the job"* - *"the implementation of national contracts may not necessarily be a good idea"*	• Keeping the market dynamic and understanding supplier/trust priorities • With top management particularly the Finance Director buy-in, there may be potential for extra resource allocation, and prioritisation on value-creation tasks not only cost-reduction. • Trusts to collaborate at a cluster / regional level to share contract innovations
Suppliers	- Variation in engagement with procurement across health trusts. An example was given of different Trusts receiving 'special customer' prices, and the variance in prices paid by different Trusts. - Everyone is busy in procurement and are deflecting requests		• Time to build relationships with procurement staff and to share best practices across all Health Trusts

The two value-based response scenarios adopted from Table 2 were: procuring the higher cost product (RICS hearing aids versus ear mould hearing aids) to see the long term service cost impact and patient time impact. With a value-based procurement outlook, the higher cost product is a more cost effective option long term. The service blueprinting outputs are seen in Figure 2 and 3.

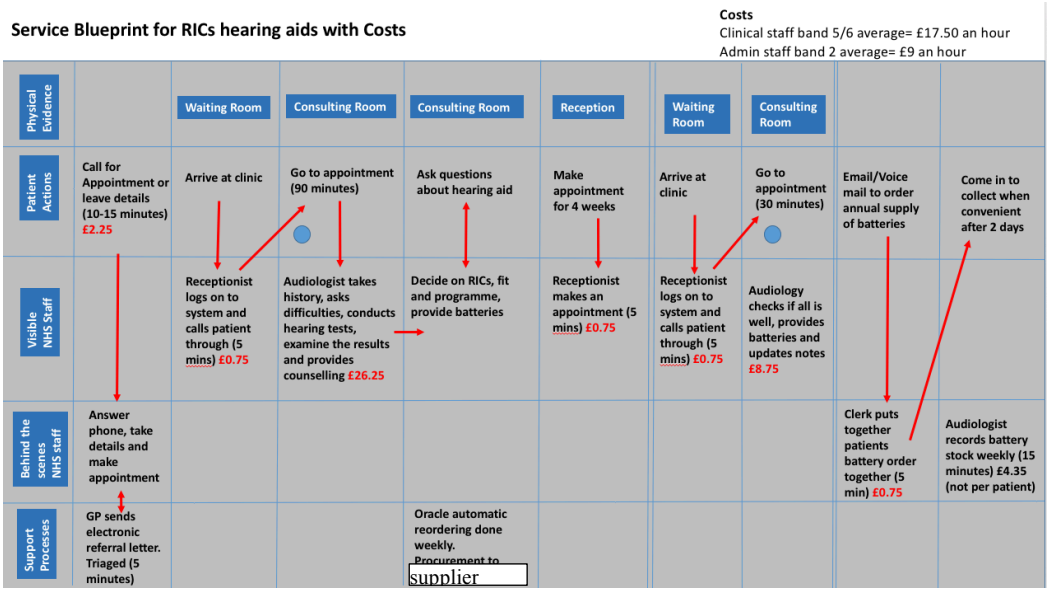

Figure 2: Service Blueprinting – high value product

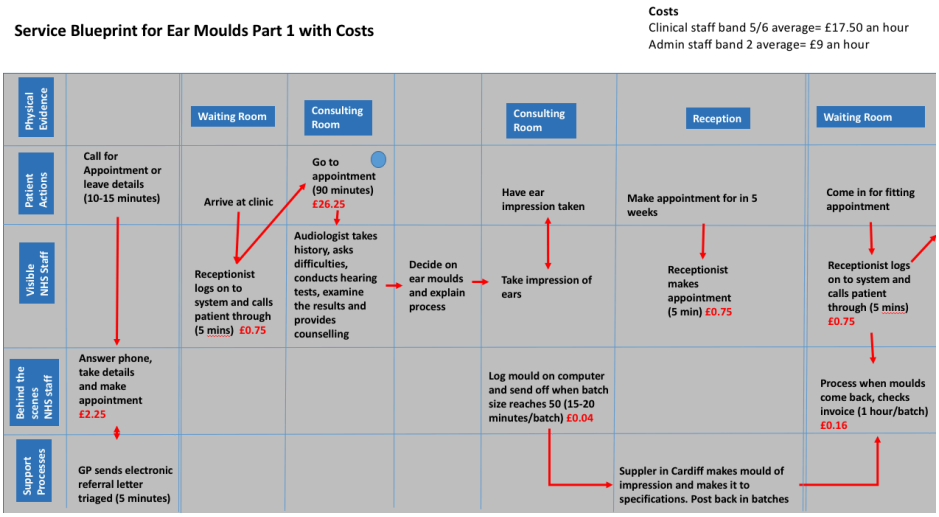

Figure 3: Service Blueprinting – low cost product

The service blueprinting demonstrated that spending an extra £3,760 on the more expensive product results in a saving of £44,255.20 in staff costs over three years. With a value-based procurement outlook, the higher cost product is a more time effective option long term as well. The service blueprinting demonstrated that procuring the higher value hearing aid saves the patient 6.5 hours over a three year period (roughly 4 clinic trips rather than 8) and saves 2.25 hours of clinical staff time and 2.2 hours of administrative staff time. Analytical findings are summarized in Tables 3 and 4.

Table 3: Audiology service blueprinting: Time impact of procuring cheaper product

Procured Hearing Aid- based on price: cheaper product			
Process	Audiology	Patient	Admin
Make appointment 1	0	15	15
Travel to and from to the appointment	0	60	0
Appointment 1- Assessment	90	90	5
Send ear mould impression	0	0	75
Make appointment 2	0	5	5
Travel to and from to the appointment	0	60	0
Appointment 2- Fitting	60	60	5
Make appointment 3	0	5	5
Travel to and from to the appointment	0	60	0
Appointment 3- Check	30	30	5
Make appointment 4	0	5	5
Travel to and from to the appointment	0	60	0
Appointment 4- Retubing	15	15	5
Make appointment 5	0	5	5
Travel to and from to the appointment	0	60	0
Appointment 5- Retubing	15	15	5
Make appointment 6	0	5	5
Travel to and from to the appointment	0	60	0
Appointment 6- Retubing	15	15	5
Make appointment 7	0	5	5
Travel to and from to the appointment	0	60	0
Appointment 7- Retubing	15	15	5
Make appointment 8	0	5	5
Travel to and from to the appointment	0	60	0
Appointment 8- Retubing	15	15	5
Total no. of minutes	**255**	**785**	**165**
Total no. of hours	**4.25**	**13.08**	**2.75**

Table 4: Audiology service blueprinting: Time impact of procuring higher value product

Procured Hearing Aid- based on value: costlier product			
Process	Audiology	Patient	Admin
Make appointment 1	0	15	15
Travel to and from to the appointment	0	60	0
Appointment 1	90	90	0
Make appointment 2	0	5	5
Travel to and from to the appointment	0	60	0
Appointment 2	30	30	5
Annual battery collection 1	0	65	5
Annual battery collection 2	0	65	5
Total no. of minutes	**120**	**390**	**35**
Total no. of hours	**2**	**6.50**	**0.58**

The findings from the service blue printing were presented in the second focus group and participants were asked to identify an aspect of the audiology service that warrants change; to agree which process could be implemented and to demonstrate the benefits of working in

partnership with suppliers. It was clear that temporal complexity, manifesting as short-termism (Laverty, 1996), in healthcare procurement emphasizes immediate payoffs by selecting the cheaper product to meet the saving targets. This is also known as "managerial myopia" (Meulbroek et al., 1990) where the short-term payoff is favoured to the long-term benefits due to high uncertainty.

The third focus group was purposely organized to widen the scope of the study to include 2 more health trusts and a larger cluster of Audiology Centers/ Departments were invited. The findings on how the Audiology Center and Procurement in Health Trust 1 respond to the temporal complexity imposed by NHS annual saving targets and relentless cost-cuttings were presented and the participants were asked to review their existing processes in relation to operational efficiency, patient centred- outcomes and service expansion opportunities. Addressing the study research question, articulated in the Introduction section, it became evident in this latter focus group that the main driving forces that create temporal complexity in healthcare procurement of product portfolios are around achieving short-term savings.

It became obvious that time featured highly in the way that healthcare procurement was operationalized to cope with the pressures of cutting costs. Time responses through delays – with laborious procurement processes and long delays in scheduling patient appointments, impose a process – slowdown to healthcare services. Another response by health providers is by carefully selecting patients for care if they meet certain eligibility care criteria. These decisions usually utilize evidence about clinical effectiveness of treatments for people with particular characteristics. Another response has been deflection where hospitals have been encouraging patients that have private medical cover to use that for expedience. These responses to temporal complexity are not aligned with contemporary notions of collaborative innovative ways of providing healthcare.

Conclusion

This current study has responded to academic and policy calls for a better understanding of the challenges of healthcare procurement to adopt value-based approaches and specifically by using the theoretical assumptions of complex adaptive systems theory we focus at the particular impact of temporal complexity and the responses to this. We argued that systemic healthcare procurement approaches that emphasize immediate payoffs through selection of the cheaper product to meet saving targets have increased temporal complexity. We have also found that temporal complexity responses such as delays to treatments, introduction of tougher selection criteria of entitled patients and deflection are creating negative effects for a long-term care environment based on enhancing patient value and supplier collaboration. Our work explored Porter et al (2017) assertion that value improvement of healthcare is about enhancing patient outputs and not simple enactment of transactional healthcare compliance processes.

This paper builds on the literature on procurement complexity in public healthcare. We contribute to scholarly arguments that complexity appears as a useful lens to explore the emerging social complexity of procurement practices in public healthcare organizations. Our specific contribution is through establishing a new focus on the relationship between temporal complexity and responses to procurement complexity. The study introduces the concept of temporality to highlight the consequences resulting from healthcare policy decisions of investment cuts and the short-term payoffs of reduced annual NHS deficits. Recent policy decisions, for example include the Forward View that challenged the health service to achieve £22 billion in savings by 2020/21, which translates to an annual saving of 2–3% (NHS England, 2014). It is easy to deduce that the imperative of cost reductions does not consider the long-term sustainability of the NHS beyond minimizing the deficit. It is obvious that short-term

economic concessions are needed however embedding value aspects in procurement processes are key to building a long-term sustainable NHS service. Maintaining a long-term orientation of NHS service in collaborations with suppliers and stakeholders would according to our case findings help deal with these temporal complexities in procurement.

In this study we firstly sought to identify the temporal realities, key challenges and operating constraints and interdependencies in public healthcare procurement. Not surprisingly the lack of time to provide valued support and prevention services beyond the core care service was highlighted. Secondly, we wanted to reflect on the local perceptions of the key problems and trade-offs associated with temporal complexity within a large busy Audiology Department in the Northwest of the UK. The notion of value-based procurement was introduced to the clinical staff, suppliers and procurement stakeholders, who often have conflicting priorities. They were prompted to identify tangible outcomes and surprisingly they opted for procuring products that are more expensive but bring long term results. Which means that in practice the short-term approach of yielding immediate benefits was of no high importance. Our emerging insights are further extended in this ongoing research looking at more health clusters in the UK.

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The Relationship between Supply Chain Leadership and Suppliers' Performance in Manufacturing Industries

Ahmad Rais Mohamad Mokhtar[1], Andrea Genovese[1], Andrew Brint[1], Niraj Kumar[2]
[1]Sheffield University Management School
The University of Sheffield
Conduit Rd, Sheffield S10 1FL
Tel: +441142223347
Email: {arbmohamadmokhtar1, a.genovese, a.brint}@sheffield.ac.uk

[2]Liverpool University Management School
The University of Liverpool
Chatham St, Liverpool L69 7ZH
Email: niraj.kumar@liverpool.ac.uk

Drawing upon social exchange theory (SET), this paper investigates the role of buyer firm's leadership approaches toward supply chain performance. Moreover, this paper examines the mediating role of trust and power on the relationship between supply chain leadership and supply chain performance. By using a sample of 190 manufacturing companies, this paper employs a structural equation modelling technique for concluding that transformational and transactional leadership were significant contributors towards supply chain performance (suppliers' quality, cost, flexibility and reverse performance), while passive leadership negatively influenced suppliers' cost performance. This study also found that trust and power mediated the relationship between supply chain leadership and suppliers' cost performance.

Keywords – Supply Chain Leadership, Performance Measurement, Buyer-Supplier Relationship, Social Exchange Theory

Introduction

Strong commitment and excellent leadership are required to improve competitiveness and sustainability of supply chains (Gosling et al., 2017). In contrast to traditional leadership, SCL is concerned with the ability of an organization (for example, the buyer firm in a supply chain) to influence followers' (for example, suppliers) actions or behaviours (Defee et al., 2009; Gosling et al., 2017). SCL has been identified as the antecedent towards supply chain performance including organizational learning (Hult et al., 2000a), purchasing cycle time (Hult et al., 2000b), supply chain efficiency (Defee et al., 2010), supply chain learning (Gosling et al., 2017), sustainability (Blome et al., 2017) and supply chain agility (Dubey et al., 2018). Unfortunately, current SCL definitions lack consistency and uniformity. Nevertheless, most of the studies have focused on transformational leadership to define SCL without any consideration on transactional leadership. To date, less emphasis has been given to transactional leadership, and no comparison has been made between leadership approaches (transformational and transactional) and non-leadership approach (passive) to fully understand the role of buyer firms' leadership style. Moreover, there is a dearth of empirical studies devoted to the relationship between SCL and other antecedents toward supply chain performance (SCP), such as inter-organizational trust and power (Harland et al., 2007; Gosling et al., 2017). This study aims at filling these gaps providing an empirical investigation into the relationship between SCL and supply chain performance, also considering the mediating role of trust and power.

Background of the Study

The concept of SCL is derived from classical leadership theories. However, in contrast to the classical or traditional leadership theories (which focus on micro and inter-personal level), SCL

focusses on macro and inter-organizational levels. Usually, in the supply chain management context, a distinction is operated between *transactional* and *transformational* leadership styles. *Transactional leadership* in SCM context is referring to the ability of the buyer firm to influence supply chain members' actions and behaviours by enforcing rewards and punishments (Birasnav et al., 2015). Birasnav et al. (2015) further deduce that buyer firms who are committed toward contract compliance such as defect inspection and quality monitoring are practising transactional leadership on their suppliers. On the other hand, *transformational leadership* in SCM context is referring to the ability of a buyer firm to motivate and stimulate their supply chain members' actions and behaviours. By exhibiting transformational leadership, supply chain leaders can enhance communication and information sharing which is essential for supply chain collaboration (Birasnav, 2013). Moreover, Hult et al., (2000a) highlight that a buyer firm practising transformational leadership can execute its organizational learning to a higher level. Overstreet et al., (2013) claim that there is a positive relationship between transformational leadership approach exhibited by the buyer firm and their operational performance. Transformational leadership of the buyer firm expanded organizational innovativeness and led to a higher financial performance of the organization.

Theoretical Background: Social Exchange Theory

SET is grounded on the concept of interaction between one person and another which lead to interdependent transactions and contingency of actions. This theory was adopted from the perspective of reciprocity, which refers to the positive exchange behaviour of the actors and rewards. Theorists believe that a positive action exhibited by a person will be responded with another positive action from the other party (Tanskanen, 2015). In addition, individuals or groups are interacting for rewards or at least with the expectation to receive rewards from other parties. In SCM context, SET has been used extensively to understand supply chain relationships, particularly the buyer-supplier relationships. To date, several SCM studies have used SET in explaining supply chain relationships such as supplier's relationship orientation (Kingshott, 2006), supplier-buyer negotiation power (Narasimhan and Nair, 2005), and supply chain servitization (Bastl et al., 2012). The concept of SCL is related to the action of buyer organizations in influencing the action of supply chain members. Derived from SET lens, supply chain members' actions and behaviours are determined by rewards or punishments received from the buyer organizations. It is not necessarily extrinsic such as contract continuation or bonuses, but also can be intrinsic such as support and motivation.

The Role of Leadership in Supply Chain Context

Defee et al. (2010) deduce that SCL is an antecedent toward SCP by articulating vision for the future, communicating the vision and motivating supply chain members. To date, there has been a little agreement on SCL definitions and dimensions. A universally accepted definition of SCL is difficult to find, and differences of opinion exist in literature. However, there seems to be some agreement that SCL refers to "*a relational concept involving the supply chain leader and one or more supply chain follower organizations that interact in a dynamic, co-influencing process. The supply chain leader is characterized as the organization that demonstrates higher levels of the four elements of leadership in relation to other member organizations (i.e. the organization capable of greater influence, readily identifiable by its behaviours, creator of the vision, and that establishes a relationship with other supply chain organizations)*" (Defee et al. 2010, pp. 766).

SCL has been identified as a vital contributor towards organizational performance in many ways. Hult et al. (2000a) outline the importance of leadership in global purchasing. Buyer organizations' leadership style has directly influenced organizational learning and reduced cycle time (Hult et al., 2000a). SCL has also been identified as a contributor towards

supplier-buyer commitment. SCL is essential for coordination between business partners. SCL will enrich activities in the supply chain and improve contact with the external suppliers (Hult et al., 2000a). Moreover, Defee et al., (2010) state that the awareness of SCL has grown in importance over the past 20 years. Transformational SCL has been tested to have a significant positive influence on the communication between supply chain members. By having a greater communication across the supply chain, business partners will be able to disseminate information and articulate their vision to achieve supply chain efficiency (the utilization of organizational resources) and effectiveness (the accomplishment of organizational goals and objectives) (Defee et al., 2010). Moreover, there is an unambiguous relationship between leadership styles and organizational innovativeness). Transformational leadership allows organization to innovate and adapt to change, in which improve the organizational performance (Overstreet et al., 2013). On top of that, a supply chain leader has to be able to integrate organizational resources to address the rapid changes in business practices (Overstreet et al., 2013). In the same vein, Birasnav (2013) discusses the importance of SCL to improve product quality and customer service level across the supply chains. The role of SCL is considered as a fundamental to surge market share and return on investments which can boost firms' overall performance. In a recent study, (Birasnav et al., 2015) explore and compare between transformational and transactional leadership toward cycle time in the supply chain activities. The impact of transformational leadership on SCP, especially cycle time, has been found to be stronger than impact of transactional leadership.

Trust and Power in Supply Chain Context

The studies on "trust" have a long history within the discipline of management and psychology (Sako and Helper, 1998). However, in SCM context, the focus on trust is deficient. As psychologists are more concerned toward inter-personal trust, scholars in SCM are more concerned towards inter-organizational trust. Inter-organizational trust in SCM context can be defined as "*one's belief that one's supply chain partner will act in a consistent manner and do what he / she says will do*" (Spekman et al. 1998, pp. 56).

Inter-organizational trust has been revealed to have a significant influence on SCP. Inter-organizational trust enhances followers' commitment which leads to a higher performance and lower transaction costs (Kwon and Suh, 2004). Moreover, inter-organizational trust will promote cooperation and collaboration among supply chain members (Gualandris and Kalchschmidt, 2016). Collaboration between supply chain members is required to ensure that current practices are aligned with the pre-determined plan. Greater openness and transparency between supply chain members can be achieved with higher inter-organizational trust (Nyaga et al., 2010). Inter-organizational trust is vital to obtain mutual benefits and collaboration. Collaboration drives both parties (buyer organizations and suppliers) to achieve economic benefits as plans and practises are executed with mutual understanding and agreement (Nyaga et al., 2010). Commitment and satisfaction between supply chain members can only be attained by having collaboration from both parties.

Power has been defined as a multi-dimensional construct that is used to influence supply chain partners to adhere to the desired requests or actions from the other parties (Ireland and Webb, 2007). To date, most of the power research in supply chain devoted their attentions to the role of coercive and non-coercive power in influencing supply chain practices. Coercive power is mostly the act of getting agreement or improving the performance of the other parties by using punishments and sanctions, while non-coercive power is related to the act of influencing other parties behaviours by providing rewards (Brito and Miguel, 2017; Meqdadi et al., 2017). Even though most of the power literature explained and discussed those concepts in term of control, coercion and legitimacy, the reward form of power seems to contribute significantly to SCP (Meqdadi et al., 2017; Ireland and Webb, 2007). Recently, the role of trust

and power has also been observed in sustainable supply chain practices (Touboulic et al., 2014). Ireland and Webb (2007) discussed that even though trust and power seem to be opposing, it is actually complementary to each other. The ability of power to substitute trust (and vice versa) whenever trust fails to achieve pre-determined or desired outcomes explains the nature of complementary between both constructs. For example, a study of IKEA sustainability practises revealed that trust alone is insufficient and exhibiting power (coercive or non-coercive) may also significantly improve the outcomes (Meqdadi et al., 2017). In this study, coercive power (coercive and legitimate) was used.

Supply Chain Performance

Performance measurement refers to the procedure and process of quantifying actions and outcomes performed by a business unit (Neely et al., 1995). The traditional performance measurement systems are limited to quantitative financial outcomes such as profit margin, cash flow and revenue (Gunasekaran and Kobu, 2007). By using a financial benchmark, a significant positive outcome seems to be obtained whenever the financial outcomes are greater or improved, for example, profit margins increment. However, this conventional measure fails to measure and quantify intangible indicators. As the recent global economy is competitive, many activities and processes are not easily identified and measured by financial outcomes. Recent needs for sustainability are not solely based on financial performance but also environmental and social performance (Seuring and Müller, 2008). Thus, the needs to develop agile business processes and strategies have forced researchers to revisit the performance measurements and metrics.

A variety of measures found and categorized by the scholars lead to difficulty in defining and conceptualizing the performance metrics. In order to overcome the complexity, a few scholars have systematically reviewed the literature to find the best metrics for SCP measurement (Shepherd and Günter, 2006; Gunasekaran and Kobu, 2007). Shepherd and Günter (2006) found 132 measures for SCP metrics in the literature. Based on the review, 55 metrics are related to cost (cost saving, warehouse costs, disposal cost), 38 metrics to quality (rejection rate, defect percentage, accuracy), 25 metrics to time (lateness, cycle time, lead time) and 14 to flexibility (production flexibility, volume flexibility). This review is consistent with Gunasekaran and Kobu (2007), who also deduce that the performance metrics are mostly related to both financial (cost) and non-financial (time, quality and flexibility). It is justified that cost, time, quality and flexibility have been used extensively in measuring SCP. As such measures have been validated by the scholars, this study will use those metrics to quantify suppliers' performance with one additional dimension, reverse performance.

Conceptual Framework and Research Hypotheses

A research framework (Figure 1) and a set of hypotheses were developed for this study: (1) to examine the relationship between SCL and SCP; and (2) to examine the mediating role of inter-organizational trust and power on the relationship between SCL and SCP.

The Relationship between Supply Chain Leadership and Supply Chain Performance

Transformational leadership exhibited by the buyer organizations is promoting organizational learning within the supply chain (Hult et al, 2000b). Moreover, by exhibiting transformational leadership, an organization will be able to reduce their cycle time which allows them to enjoy minimum lead time or production downtime (Hult, Ferrell, et al., 2000a). Nevertheless, transformational leadership has been identified as an antecedent towards supply chain cost improvement (such as manufacturing cost), flexibility (innovation and ability to change), quality (product quality) and sustainability (green manufacturing, green supply chain) (Blome et al., 2017; Dubey et al., 2015; Sharif and Irani, 2012). Two dimensions in transactional

leadership also have been identified as antecedents in enhancing supply chain practises. In contrast with transformational leadership, transactional leadership is focusing on extrinsic rewards (such as long-term contract and investment) while transformational leadership is focusing on intrinsic needs of the supply chain members (such as motivation and commitment) (Blome et al., 2017; Birasnav et al., 2015). As the positive actions of an individual or groups are determined by the rewards or exchange means received over time, this study proposed that:

H1: Transformational leadership is positively related to SCP.
H2: Transactional leadership is positively related to SCP.
H3: Passive leadership has no significant relationship on SCP.

The Relationship between Supply Chain Leadership and, Trust and Power

The relationship between leadership and trust has been researched extensively in psychological and organizational behaviour fields. Transformational leadership has been identified as a strong predictor of employees' trust (Dirks and Ferrin, 2002). By exhibiting appropriate leadership approaches or styles, an organization will be able to enhance employees' trust and psychological well-being in which lead them to achieve job satisfaction and commitment. Even though there are limited studies on the relationship between SCL and trust, few scholars proposed that SCL can enhance trust between supply chain partners and lead to higher performance of the supply chain including reduction in cycle time and supply chain alliances (Birasnav et al., 2015). This phenomenon is also justified by the literature in which when a desirable action performed by a supply chain leader (motivation and intellectual stimulation), a supply chain member will respond with another positive action such as integrity and reliability of their actions, information or agreements. As mentioned previously, the concept of trust and power is co-exist and interdependent. Both trust and power shall exist in supply chain relationship as it provides relational exchange of supply chain partners. In this study, transformational leadership is seen as the contributor towards trust, while transactional leadership is more towards power-based relationship which are coercive and legitimate power. Hence, this study proposed the second set of hypotheses:

H4: Transformational is positively related to trust.
H5: Transactional leadership is positively related to power.
H6: Passive leadership has no significant relationship on trust and power.

The Relationship between Trust and Power, and Supply Chain Performance

Trust and power are recently being identified as the main mechanisms that can be used simultaneously to influence supply chain partners. However, most of conventional literature has separated trust and power-based supply chain relationships in which they argued that trust and power are unable to be executed together. Even though trust and power exist in different constructs and dimensions, it is actually interdependent rather than independent (Pulles et al., 2014; Yeung et al., 2009). Yeung et al., (2009) address that both trust and power improved internal and supplier integration. Trust and power have also led to a positive outcome on supplier resource allocation in which by exhibiting higher trust and power, a buyer firm will be able to convince (trust) or force (power) their suppliers to invest on the physical and innovation resources (Pulles et al., 2014). The authors further deduce that a buyer firm with a higher share in the supplier can use power to influence or force the suppliers. However, a buyer firm with a lower share should only use trust to influence their suppliers. Hence, this study proposed the third and fourth set of hypotheses:

H7: Trust is positively related to SCP.
H8: Power is positively related to SCP.
H9: Trust mediates the relationship between transformational leadership and SCP.
H10: Power mediates the relationship between transactional leadership and SCP.
H11: Power and trust do not mediate the relationship between passive leadership and SCP.

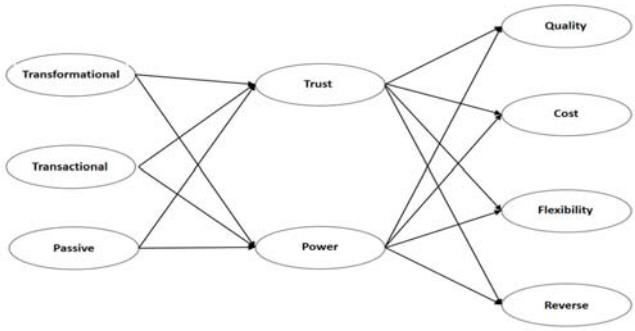

Figure 1: Conceptual Framework of the Study

Research Methodology

Construct Measurements

The main constructs in this research model are transformational, transactional and passive leadership as predictor variables; trust and power as mediators; and cost, quality, flexibility and reverse performance as the outcomes. The constructs were measured on a seven-point Likert-scale ranging from strongly disagree (or poor for performance) (1) to strongly agree (or excellent for performance) (7). The measures for transformational, transactional and passive leadership were adapted from Defee et al. (2010), Defee et al. (2009) and Avolio et al. (1999). The items in the questionnaire were designed to capture the leadership styles exhibited by the buyer firms toward their suppliers. Measures for trust were adapted from Liu et al. (2015), which designed to capture suppliers' trust towards their buyer firm. Measures for power were adapted from Nyaga et al. (2013). The questions for power were aimed to capture the exercise of reward, coercive and legal legitimate power by the buyer firms toward their suppliers. Finally, measures for suppliers' performance were adapted from multiple sources including Hazen et al. (2015), Olugu and Wong (2012), Kristal et al. (2010), Gunasekaran and Kobu (2007), Shepherd and Günter (2006). However, since the suppliers' performance might be interpreted differently in different industries, the items were modified based on the consultation with the panel of experts (academic and industry) during the pre-testing sessions. This study controlled for firms' size and their position in the supply chain (for example, tier-1 vs tier-2 suppliers). The unit of analysis was the senior level management in supplier firms (tier-1 onwards).

Survey Design and Sample Characteristics

The manufacturing companies surveyed for this study included top, middle and lower managers across various sectors including automotive, steel, oil and gas, fast moving consumer goods (FMCG), pharmaceutical, tobacco, rubber, chemicals, electronics and machinery. The survey sample was identified using Federation of Malaysian Manufacturer directory and the research team own industrial contacts. In total, 830 surveys questionnaire were distributed and 225 participants responded. However, the final responses were 190 as 35 responses were removed due to significant incomplete or missing data (23% or response rate). The respondents were working in 16 different sectors where the highest representatives were from automotive

(22.1%), electrical and electronics (16.8%), and, metal and machinery (15.3%). Furthermore, 57.4% of the companies responded for the survey were privately owned. Half of the respondents were in middle management position (53.2%). 35% of the respondents were the senior management while 11.1% were lower management. The highest representative of the sample for this study was the respondents who worked in the firm for more than 10 years (43.2%), followed by 2-5 years (31.6%), 6-10 years (20.5%) and less than 1 year (only 4.7%). The details of respondents' experience distribution are shown in Table 5.8. Finally, majority of the respondents (63.2%) were working in tier-1 firms while 23.7% in tier-2 and 13.2% in tier-3. However, 95.3% of the respondents stated that they were normally interacting with the focal firms.

Data Screening

The dataset used for this study was not suffering from extreme outlier and no response was removed, transformed or modified. Furthermore, the dataset did not contain extreme skewness and kurtosis based on the recommendation by Hair et al. (2014), which the value is within the range of -1 to +1. The multicollinerity test revealed that there was no multicollinearity between the independent variables as the tolerance value was more than .10 and the variance inflation factor (VIF) was less than 10.

Exploratory Factor Analysis

Prior to performing the EFA, it is necessary to measure the suitability of the data and its sampling adequacy. The Kaiser-Meyer-Olkin (KMO) test is useful to indicate whether the factor analysis is useful for the data (closer to 1.0 is better, with .6 is the minimum value for good factor analysis), while Bartlett's test of sphericity used to measure the significance p value which should be less than .001 (Pallant, 2016). KMO and Bartlett's Test was used to measure the suitability and it reveals that the sample was adequate (range from .888 and above) and the significant values were .000 ($p < .001$).

A total of 30 items were used to measure SCP, 21 items for trust and power, and 23 items for SCL. EFA using Principal Axis Factoring (PAF) extraction and Promax rotation matrix revealed that only 4 factors can be extracted based on eigenvalue more than 1 for SCP. Based on EFA, only four factors were retained for further analysis which are cost performance, quality performance, flexibility performance and reverse performance. EFA revealed that 4 factors can be extracted based on eigenvalue more than 1 for trust and power. The screeplot was also suggesting that the trust and power variables could be explained from four-factor structure. However, after further investigation on the pattern matrix, the fourth factor should not be retained as the items were cross-loaded with the first factor. The third factor consisted of 2 trust items and 1 power item, however, since there is no theoretical justification to explain those items in a single construct, all items were removed (Field, 2013). Hence, only two factors were retained to measure trust and power. Finally, EFA revealed that 3 factors can be extracted based on eigenvalue more than 1 for SCL. Those 3 factors are transformational leadership, transactional leadership, and passive leadership.

This study decided to use only top three items based on their factor loading to represent each factors. The practise of using items with the highest loadings (also known as surrogate items) is common as those items are having a greater influence on their respective factor (Dubey et al., 2015; Hair et al., 2014). Three items were chosen as it suits the rules for standard confirmatory factor analysis models which a factor should has at least three indicators (items) (Kline, 2016). Hence, 27 items were retained for subsequent examination using confirmatory factor analysis.

Confirmatory Factor Analysis

By using nine-factor model identified during the EFA (4 factors for performance, 2 factors for trust and power, and 3 factors for SCL), the initial measurement model was created. The measurement model was statistically adequate: Chi-square ($\chi 2$) = 459.633, degrees of freedom (df) = 288, chi-square goodness-of-fit ($\chi 2$/df) = 1.596, comparative fit index (CFI) = 0.959, Tucker-Lewis index (TLI) = 0.950, Bollen's incremental fit index (IFI) = 0.959, standardized root mean squared residual (SRMR) = 0.051, and root mean squared error of approximation (RMSEA) = 0.056.

Model Reliability and Validity

Cronbach's alpha and composite reliability (CR) were used to check the reliability of the model, while average variance extracted (AVE) was used to estimate convergent and discriminant validity. The lowest alpha for the variable was 0.810 (transformational leadership), which is higher than the recommended cut-off alpha value (0.7) (Pallant, 2016). It indicated that each items in the variable or construct were measuring the same attribute. Similarly, the lowest CR value was 0.804 (passive leadership), higher than the cut-off value of 0.70 (Hair et al., 2011). The square root of AVE showed that the variables were more related to its own measure instead of other dimensions (based on cut-off value of 0.50 recommended by Hair et al., (2014)). In a simpler word, it can be concluded that the items in the variables were measuring at least 76.4% of their own variable rather than any other (the lowest AVE value was 0.764 for passive leadership). The tests confirmed that the variables used in the model were not having any reliability as well as convergent and discriminant validity issues.

Common Method Bias and Measurement Model Invariance Test

By using an approach proposed by Podsakoff et al. (2003), a common method bias test using common latent factor (CLF) was carried out. The test revealed that there was no significant difference on the standardized regression weight before and after the common latent factor was added. Thus it can be concluded that no common method bias was reported for this study. The measurement model invariance test was conducted in order to identify the consistency of the factor structure on different groups. Two group were tested which are (i) Tier 1 Firms vs Tier 2 and Tier 3 Firms, and (ii) Small and Medium Enterprises (SMEs) vs Large Corporations. The test showed insignificant difference for the chi-squared between unconstrained and fully constrained models across the 4 multi-groups, indicating that the factor structure was consistent across all groups in the dataset. These findings confirmed that the dataset met the condition for configural invariance (same structure across groups) (Milfont and Fischer, 2010).

Findings and Discussions

The overall fit of the hypothesised structural model was adequate with the following fit indices: Chi-square ($\chi 2$) = 616.582, degrees of freedom (df) = 341, chi-square goodness-of-fit ($\chi 2$/df) = 1.808, comparative fit index (CFI) = 0.934, Tucker-Lewis index (TLI) = 0.922, Bollen's incremental fit index (IFI) = 0.935, standardized root mean squared residual (SRMR) = 0.08, and root mean squared error of approximation (RMSEA) = 0.065. All hypotheses were tested while controlling for firm's size and their supply chain position. The direct and mediation tests were conducted independently on the full model to ensure greater clarity and parsimony.

Direct Relationship Between Supply Chain Leadership and Supply Chain Performance

Table 1 shows that transformational and transactional-based SCL were equally contributing to SCP. Even though most of the literature in this domain argued that transformational leadership is the sole contributor towards SCP, this empirical study found that the role of transactional leadership is not supposed to be ignored by the scholars and practitioners. Both

transformational and transactional leadership are highly influential in improving suppliers' quality, cost, flexibility and reverse performance. Nevertheless, exhibiting passive leadership approach had no significant effect on suppliers' quality, flexibility and reverse, which means it had no influence in improving suppliers' performance in that respective dimensions. However, this study noted that by exhibiting passive leadership, suppliers' cost performance had worsened, which could contribute to increment of their products' cost and price.

Table 1: The Relationship between SCL and SCP

Independent	Path	Dependent	Standardized Path Coefficient
Transformational	→	Quality	0.425***
Transformational	→	Cost	0.452***
Transformational	→	Flexibility	0.316***
Transformational	→	Reverse	0.350***
Transactional	→	Quality	0.293***
Transactional	→	Cost	0.320***
Transactional	→	Flexibility	0.389***
Transactional	→	Reverse	0.231**
Passive	→	Quality	-0.103 NS
Passive	→	Cost	-0.312***
Passive	→	Flexibility	0.047 NS
Passive	→	Reverse	-0.135 NS

*p <.05, ** p <.005, *** p <.001, NS – Not Significant

Direct Relationship Between Supply Chain Leadership, Trust and Power

Table 2 shows that transformational was a significant contributor towards trust, while transactional leadership was a significant contributor towards power. Moreover, this study found that passive leadership had a negative relationship towards power. By practising transformational leadership, buyer firms will be able to enhance suppliers' trust. On the other hand, by practising transactional leadership, the exercise of power tends to be higher as the buyer firm are more likely to monitor and control suppliers' performance by looking into suppliers' obedience to pre-determined rules or procedures. In opposition to transformational and transactional leadership, passive leadership had no influence on suppliers' trust, however it negatively effects the power exercise by the buyer firms.

Table 2: The Relationship between SCL, Trust and Power

Independent	Path	Mediator	Standardized Path Coefficient
Transformational	→	Trust	0.615***
Transformational	→	Power	0.061 NS
Transactional	→	Trust	0.069 NS
Transactional	→	Power	0.514***
Passive	→	Trust	-0.024NS
Passive	→	Power	-0.205**

*p <.05, ** p <.005, *** p <.001, NS – Not Significant

Direct Relationship Between Trust, Power and Supply Chain Performance

Table 3 presents the final direct relationship analysis between the variables, the mediator and independent variables. This study found that trust had a significant positive relationship towards all dimensions of suppliers' performance (quality, cost, flexibility and reverse). This study also found that power had a significant positive relationship towards suppliers' cost and reverse performance, but not towards quality and flexibility performance.

Table 3: The Relationship between Trust, Power and Supply Chain Performance

Mediator	Path	Dependent	Standardized Path Coefficient
Trust	→	Quality	0.386***
Trust	→	Cost	0.471***
Trust	→	Flexibility	0.348***
Trust	→	Reverse	0.326***
Power	→	Quality	0.122 NS
Power	→	Cost	0.339***
Power	→	Flexibility	0.139NS
Power	→	Reverse	0.222***

*p <.05, ** p <.005, *** p <.001, NS – Not Significant

The Mediating Effects of Trust and Power

The second objectives of this study is to understand the underlying reasons for explaining the relationship between SCL and supplier's performance by testing the mediating role of trust and power. Even though the direct relationship between variables existed (i.e: transformational leadership to trust, trust to suppliers' performance), the structural model revealed that the relationship between SCL and suppliers' performance was not completely mediated by trust or power. The findings discovered that the role of trust and power were significant as the mediator on towards suppliers' cost performance. Trust partially mediated the relationship between transformational leadership and cost performance, while power partially mediated the relationship between transactional leadership and cost performance. Similarly, power partially mediated the relationship between passive leadership and cost performance. It can be concluded that the relationship between transformational leadership and cost performance was partially explained by trust. By exhibiting transformational leadership, buyer firms are able to enhance suppliers' trust on their firm, which at the end improve suppliers cost performance. As the buyer firm motivating, inspiring and stimulating suppliers' intellectual, the suppliers tend to believe that they buyer firms are transparent and honest with them. Due to that, they are willing to innovate and invest more to improve their operations, which lead mostly to the improvement of the cost such as manufacturing and inventory costs.

Similarly, power has been found as the mediator between transactional leadership and cost performance. The relationship between transactional leadership was partially mediated by power as the nature of transactional leaders are to apply reward and punishment scheme, as well as highly monitoring and auditing approaches. This will lead them to exercise high power, in order to ensure suppliers' obligation and obedience towards their requirements. By exercising high power, suppliers will carefully monitor their own performance, so that they will not violate the contract which can cause them subsequent penalty including business termination. In contrast, by exhibiting passive leadership, the buyer firm will not demonstrate their power, in which has a negative impact towards suppliers' cost performance. For instance, a passive leadership firm will not make any decision and suggestion for their suppliers' in terms of suppliers' production plan or operations. Using this approach, the buyer firm indirectly uses less power as they do not monitor their suppliers and do not concern about their suppliers' compliance, which can lead to poor cost management. Table 5 shows the bootstrap results for assessing the significance of indirect effects of the mediators. Table 6 presents the summary of the hypotheses testing.

Table 5: The Relationship between Trust, Power and Supply Chain Performance

Relationship	Direct Effect Without Mediator	Direct Effect With Mediator	Indirect Effect (95% Bias-corrected CI)	Bootstrap CI		Remarks
				Lower	Upper	
Transformational→Trust→Quality	.425***	.309**	.085 NS	-0.089	0.266	No Mediation
Transformational →Trust→Cost	**.452*** **	**.233** **	**.189***	**0.069**	**0.34**	**Partial**
Transformational→Trust→Flexibility	.316***	.194*	.097 NS	-0.086	0.286	No Mediation
Transformational→Trust→Reverse	.350***	.210*	.112 NS	-0.036	0.255	No Mediation
Transactional→Power→Quality	.293***	.304***	-.017 NS	-.141	0.103	No Mediation
Transactional→Power→ Cost	**.320*** **	**.193***	**.127***	**0.027**	**0.281**	**Partial**
Transactional→Power→Flexibility	.389***	.408***	-.021 NS	-.153	0.085	No Mediation
Transactional→Power→Reverse	.231**	.149***	.081 NS	-0.052	0.218	No Mediation
Passive→Power→Quality	-.103 NS	-.106 NS	.008 NS	-0.045	0.079	No Mediation
Passive→ Power→Cost	**-.312*** **	**-.257*** **	**-.058***	**-0.149**	**-0.007**	**Partial**
Passive→Power→ Flexibility	.047 NS	.040 NS	.010 NS	-0.034	0.084	No Mediation
Passive→Power→Reverse	-.135 NS	-.093 NS	-.037 NS	-.123	0.019	No Mediation

*p <.05, ** p <.005, *** p <.001, NS – Not Significant

Table 6: Summary of Hypotheses Testing Results

Hypotheses	Result
H1: Transformational is positively related to SCP.	Accepted
H2: Transactional leadership is positively related to SCP.	Accepted
H3: Passive leadership has no significant relationship on SCP	Rejected
H4: Transformational is positively related to trust.	Accepted
H5: Transactional leadership is positively related to power.	Accepted
H6: Passive leadership has no significant relationship on trust and power.	Rejected
H7: Trust is positively related to SCP.	Accepted
H8: Power is positively related to SCP.	Accepted for Cost and Reverse
H9: Trust mediates the relationship between transformational leadership and SCP.	Accepted for Cost
H10: Power mediates the relationship between transactional leadership and SCP.	Accepted for Cost
H11: Power and trust do not mediate the relationship between passive leadership and SCP.	Rejected for Cost

Conclusion

Drawing upon social exchange theory, this study developed and tested a framework to examine the relationship between SCL and suppliers' performance. The findings offer guidance to the firms across the supply chain networks on the role of buyer firm's leadership approach and its influence towards suppliers' performance. This study also provides an avenue for both parties, buyer and supplier, to understand how the leadership of the buyer firms contributed to cost suppliers' performance via trust and power. Results of the study indicated that the direct relationship of SCL and suppliers' performance existed, which transformational and

transactional leadership approaches led to higher quality, cost, flexibility and reverse performance. The study also found a new result where passive leadership (non-leadership approach) deteriorated the cost performance of the suppliers. The 'full-range' leadership approach (consisting of elements of both transformational and transactional leadership) should be considered by practitioners for improving their buyer-supplier relationships. As the relationship with each supplier is unique, different leadership approaches might be needed and the concept of relying only into one type of leadership (either just transformational or transactional) and generalizing it to all buyer-supplier relationships are extremely perilous. Moreover, this study found that trust and power were significant mediators between SCL and suppliers' cost performance. The relationship between transformational leadership and suppliers' cost performance was partially explained by trust, while the relationship between transactional leadership and suppliers' cost performance was partially explained by power. It is apparent from this study that transformational leadership improved suppliers' trust on the buyer firm, while transactional leadership increased power exercised by the buyer firms. Both leadership approaches improved different mechanisms but led to a higher performance of suppliers' cost performance. It can be further explained by saying that transformational leadership used trust as the instruments to enhance suppliers' cost performance, whereas transactional leadership used power as the instruments to achieve the same goal. It is aligned with the result discovered for the passive leadership approach, in which it led to lack of power exercised by the buyer firm that negatively impacted suppliers' cost performance.

This study contributes directly to the leadership theory by expanding the classical intra-organizational leadership to inter-organizational leadership from the perspective of supply chain management environment. The result affirms that the role of buyer firms' leadership approach is significant towards suppliers' performance. Secondly, this study further validates social exchange theory by providing the empirical evidence of social exchange practises (leadership, trust and power) influence on suppliers' performance. The finding asserts that leadership, trust and power are three important antecedents towards suppliers' performance, especially towards cost performance. Finally, this study further adds to operations and supply chain management literature by proposing the 'full-range' leadership approach that should be implemented in order to improve suppliers' performance, where the passive leadership approach is definitely should be reduced. This study focussed on the leadership approach of the buyer firm towards suppliers' performance on a dyadic supplier-buyer relationship (based on immediate buyer-supplier). Accordingly, future studies could adopt a triadic approach to examine the buyer firms' leadership approach penetration beyond tier-1 suppliers.

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A user-friendly decision making tool for vendor selection: A hybrid-MCDM algorithm

Ahmed Mohammed[*1], Abdulsalam Dukyil[2] and Mohamed Darwish[2]

[1*]Business School, Cardiff University, Aberconway Building, Colum Dr, Cardiff, UK CF10 3EU
+447405332527
[2]Electronic and Computer Engineering, College of Engineering, Design and Physical Sciences, Brunel University London, Uxbridge, UK UB8 3PH
ece80495@myport.ac.uk

Abstract
This study is motivated by a real-life problem as it aims to provide a user-friendly decision making tool used to select the best vendor from among the group towards their tenders submitted to implement a proposed radio frequency identification (RFID)-based passport tracking system. The DEMATEL algorithm is proposed to determine the importance weight of each criteria and the obtained weights are then to be integrated into the ELECTRE algorithm proposed to evaluate the performance of vendors. The efficiency of the proposed tool is to be evident from the real case study.

Keywords: Vendor selection; Traditional and Resilience; MCDM.

Submission category: working paper

Introduction

Vendor selection is a main key factor in implementing a robust business (Amid et al., 2006). This is based on the fact that enterprises depend more on suppliers to obtain a cost-effective high performance. Furthermore, purchasing activity is one of the main task for enterprises since its costs represent more than 50% of all enterprises 'internal costs (Mohammed et al. 2017; and Yazdani et al., 2016). Vendor selection can be defined as the activity of selecting the best vendor based on their tenders towards a number of criteria for obtaining a stabilized environment of competitiveness. Generally, it is a major concern and a challenge for decision makers since several uncontrollable and unpredictable factors are involved (Mohammed et al., 2018). Where an impropriate selection may compromise financial and operational status of the enterprise (Araz and Ozkarahan, 2007; and Faez et al., 2006). Thus, it is regarded as a complex, multi-criteria decision-making activity since different and conflicting criteria should be considered and assessed to assign consistent vendors.

In the context of criteria, decision makers are normally evaluating vendors based on their performance towards traditional criteria such as costs and quality neglecting resilience criteria (e.g., agility and flexibility) which is a paramount to sustain and improve their service. For instance, due to Japan's earthquake in 2011, Apple negatively affected in producing iPad 2 due to lack of flash memory and super-thin battery (BBC News, 18 Mar 2011). This event also interrupted the automotive sector and retail supply chains in the UK (Hall, 16 Apr 2010). Thus, enterprises ultimately have realized that their selecting method which encounters traditional criteria as the only criterion is inefficient and needs to be changed.

Several research studies have presented to solve Vendor selection problem. Amin et al. (2011) proposed a fuzzy SWOT method used to evaluate the vendor. Khaleie et. al. (2012) used ranking

process on the two indices, score function and accuracy function, to rank the alternatives. Haldar et al. (2014) developed a fuzzy multi-criteria decision making (MCDM) approach for supplier selection considering the importance degrees of specific attributes as linguistic variables formulated by triangular and trapezoidal fuzzy numbers. Torabi et al. (2015) proposed a fuzzy stochastic bi-objective optimization model to solve a SS/OA problem to improve the supply chain resilience under operational and disruption risks.

The literature review shows that there is a gap in this body of knowledge in terms of presenting a trasilient vendor selection approach that can help decision makers to encounter the traditional issues and unexpected disruptions, simultaneously. Within this boundary, this study presents a development of a hybrid decision making tool aiming to select the best tender presented from 7 vendors to implement a real RFID-based passport tracking system. First, a framework was developed for defining the trasilience criteria and sub-criteria (e.g. traditional pillar such as costs and delivery commitment and resilience criteria such as agility and flexibility). Second, DEMATEL was used to determine the importance weight for each trasilience criteria and sub-criteria. Third, ELECTRE was used to evaluate and rank vendors with respect to their trasilience performance.

Preliminaries

Quantifying criteria: decision-making trial and evaluation laboratory (DEMATEL)

DEMATEL is a multi-attribute decision making algorithm used to determine the weights of attributes and to evaluate the interaction relationship between different variables of a complicated system to establish direct and indirect causal relationships and influence levels among them. The implementation of DEMATEL includes the following steps (Tzeng et al., 2007):
Step 1: Generate the linguistic evolution decision matrix based on decision makers 'expert. In this research the linguistic evaluation and its correspondence quantitative scale is shown in Table 1.
Step 2: The linguistic evolution obtained from step 1 was converted using the quantitative scale shown in Table 1 to the correspondence scale to generate a pairwise comparison decision matrix among the three objectives.

$$A_{ij} = \begin{bmatrix} r_{11} & r_{12} & r_{1j} \\ r_{21} & r_{22} & r_{2j} \\ . & . & . \\ . & . & . \\ r_{i1} & r_{i2} & r_{ij} \end{bmatrix}$$

Where A_{ij} represents a pairwise decision matrix, in which the element a_{ij} denotes the level to which the ith attribute influence the jth attribute.
Step 3: The aggregated normalized decision matrix N was built based on decision matrix generated in step 2 using Eq.1.

$$N = A.K \quad (1)$$

Where

$$K = \frac{1}{\max\limits_{1<i<n}\left(\sum\limits_{j\in n} r_{ij}\right)}; i, j = 1,...,n \tag{2}$$

Step 4: Generate the total-relation matrix *T* using Eq. 3, in which I denotes the identity matrix. The matrix *T* reveals the total relationship between each pair of decision attribute.

$$T = N\left(I - N\right)^{-1} \tag{3}$$

Step 5: Sum rows and columns of matrix *T* using Eqs. 4 and 5. These two summations are resented by D and R vectors.

$$D_i = \left[\sum_{j\in n} t_{ij}\right]_{nx1}; i = 1,2,...,n \tag{4}$$

$$R_j = \left[\sum_{i\in n} t_{ij}\right]_{1xn}; j = 1,2,...,n \tag{5}$$

Step 6: Define a threshold value *a*. Matrix *T* shows information on how one attribute influences another, it thus becomes required for the decision makers to define a threshold value *a* for elucidating the structural relation among attributes while simultaneously keeping the intricacy of the entire system to a convenient level. An influence relationship between two attributes is excluded from the evaluation if their correlation value in matrix *T* is smaller than *a* and only the effects greater than the set *a* value are chosen and shown in the digraph. In this work, the threshold value *a* is determined from the average of the values in matrix *T* using Eq. (6), where *N* is the total number of values in matrix *T*.

$$a = \frac{\sum\limits_{i\in n}\sum\limits_{j\in n} t_{ij}}{N} \tag{6}$$

Step 7: Build the relationship table by summing *D* and *R* and subtracting *D* from *R* in which *D*+*R* vector reveals how much importance the criterion has. The *D*-*R* vector divide the attribute into the causal and effect groups. Generally, a positive value of *D*-*R* refers to the attributes that belongs to the causal group and if the *a* negative value *D*-*R* refers to the attributes that belongs to the effect group.

Step 8: Use Eq. (7) to determine the importance weight for each attribute by normalizing the *D*+*R* vector in which the sum of normalized weights equals to 1.

$$w_i = \frac{\left(D+R\right)_i}{\left(\sum\limits_{i\in n}\left(D+R\right)_i\right)}; i = 1,2,...,n \tag{7}$$

Table. 1. Linguistic variables and correspondence scales used for evaluating the trasilience criteria and sub-criteria

Linguistic Variable	Scale
No influence (NI)	0
Lo influence (LI)	1
Medium influence (MI)	2
High influence (HI)	3
Very high influence (VHI)	4

Ranking vendors : ELimination Et Choix Traduisant la REalité (ELECTRE)

Bernard Roy developed ELECTRE algorithm at SEMA Consultancy Company to rank several alternatives. It is a Multi Criteria Decision Making (MCDM) algorithm used to evaluate and rank a number of alternatives from the best to the worst. ELECTRE applies a pairwise comparison among alternatives with respect to the required criteria' weights aiming to calculate the concordance and discordance sets. In this algorithm, different types of matrices are constructed based on the concordance and discordance sets and then uses the threshold values to filter the less favorable alternatives and select the better ones (Figueira et al., 2005). So far, ELECTRE is one of the most important evaluation MCDM algorithms employed for applications in real life MCDM problems, since it is based on the construction and exploitation of a valued "outranking relation" (Hwang and Yoon, 1981). The main procedures to apply ELECTRE for the evaluation and ranking of vendors can be described as follows:

1. Table 2 presents the linguistic variables and the correspondent numbers that were used to evaluate vendors' performance towards each criterion. This evaluation is based decision makers' expert since they need to give their opinions about the performance of each supplier with respect to **trasilience** criteria.
2. Construct the basics decision matrix A_{ij} as the number of matrix rows (i) and matrix columns (j) refer to the alternatives and the criteria respectively.

$$A_{ij} = \begin{bmatrix} r_{11} & r_{12} & r_{1j} \\ r_{21} & r_{22} & r_{2j} \\ . & . & . \\ . & . & . \\ r_{i1} & r_{i2} & r_{ij} \end{bmatrix}$$

3. Normalize the decision matrix as follows:

$$v_{ij} = \frac{r_{ij}}{\left(\sqrt{\sum_i r_{ij}^2}\right)} \tag{8}$$

Where the normalized decision matrix V_{ij} is presented as follows:

$$V_{ij} = \begin{bmatrix} v_{11} & v_{12} & v_{1j} \\ v_{21} & v_{22} & v_{2j} \\ . & . & . \\ . & . & . \\ v_{i1} & v_{i2} & v_{ij} \end{bmatrix}$$

4. Constructed the normalized weighted decision matrix W_{ij} by multiplying the normalized decision matrix by the criteria weight (w_i) revealed via DEMATEL.

$$W_{ij} = V_{ij} x\ w_j \tag{9}$$

5. Apply Eqs. 10 and 11 to determine the concordance and discordance sets, respectively. Concordance matrix is constructed by adding the values of weights of Concordance set elements. Discordance matrix is constructed by dividing discordance set members values to total value of whole set.

$$C_{lm} = \sum_{j^*} w_{j^*} \tag{10}$$

$$D_{ab} = \frac{\left(\sum \left| W_{aj^*} - W_{bj^*} \right| \right)}{\left(\sum \left| W_{aj} - W_{bj} \right| \right)} \tag{11}$$

where, $C(a,b) = \left\{ j,\ W_{aj} \geq W_{bj} \right\}$ and $D(a,b) = \left\{ j,\ W_{aj} < W_{bj} \right\}$.

6. Constructs the binary concordance and discordance matrices based on the obtained the sets obtained in step 5.
7. Rank the alternative by constructing the aggregated binary concordance and discordance matrices by the binary multiplication of the concordance and discordance matrices.

Table 2. Linguistic variables used for evaluating vendors

Linguistic Variable	Scale
Very Low (VL)	1
Low (L)	3
Medium (M)	5
High (H)	7
Very High (VH)	9

Research Methodology

This research aims to develop a user-friendly decision making tool as an aid to decision makers at an institution to select the best tender out of 7 proposed to implement an RFID-based passport tracking system considering traditional criteria and resilience criteria. Objectives of this work are as follows:

1) To develop a unified trasilience framework for the evaluation criteria categorized into two sections which include traditional criteria and resilience criteria.

2) To use the linguistic evaluation of decision makers to determine the qualitative importance of criteria and sub-criteria using the evaluation scale presented in Table 1. Tables 3 and 4 show the potential decision matrix to be given to decision makers.
3) To use the DEMATEL algorithm to determine the quantitative importance of criteria and sub-criteria.
4) To use the linguistic evaluation of decision makers to determine the qualitative importance of vendors towards the identified criteria using the evaluation scale presented in Table 2. Table 5 shows the evaluation table to be given to decision makers.
5) To use the ELECTRE algorithm to determine the quantitative importance and ranking of vendors based on their trasilience performance.
6) To validate the developed decision making tool based on a real case study.

Table 3. Decision matrix among traditional criteria

Criteria	TC1	TC2	TC3	TC4	TC5	TC6	TC7
TC1	1						
TC2		1					
TC3			1				
TC4				1			
TC5					1		
TC6						1	
TC7							1

TC: Traditional criteria

Table 4. Decision matrix among resilience criteria

Criteria	RC1	RC2	RC3
RC1	1		
RC2		1	
RC3			1

RC: Resilience criteria

Table 5. Evaluation of vendors

Criteria	Sub-criteria	V_1	V_2	V_3	V_4	V_5	V_6	V_7
Traditional	TC1							
	TC2							
	TC3							
	TC4							
	TC5							
	TC6							
	TC7							
Resilience	RC1							
	RC2							
	RC3							

V: Vendor

Main research findings

In this study, we end up with a user-friendly decision making tool that identifies the main trasilience criteria as shown in Figure 1 and then quantifying them using the DEMATEL algorithm. Finally, the ELECTRE algorithm is to be used to evaluate and rank the performance of 7 vendors to implement the RFID-based passport tracking system.

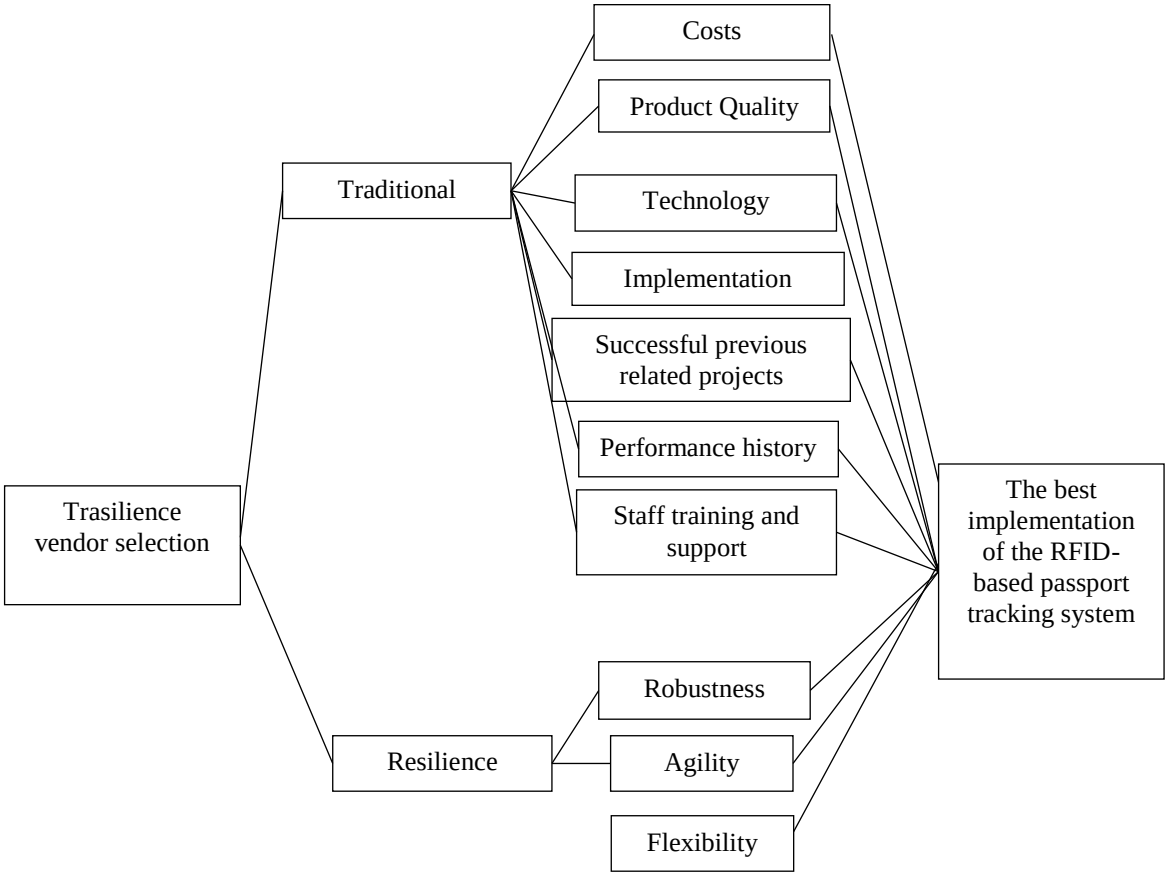

Figure 1. A hierarchal framework for the Trasilient vendor selection.

Conclusions

Vendor selection is one of the strategic decision in enterprises that should carefully considered as impropriate vendor may financially compromise the enterprise status and results in a bad project implementation which leads to an improper service level. Vendor selection problem has been studied extensively using MCDM algorithms. However, the performance of potential vendors is evaluated against multiple traditional criteria such as cost and quality lacking behind the importance resilience criteria which help in sustaining long-term service performance.

This study solves a real industry vendor selection problem using MCDM algorithm considering traditional and resilience criteria and sub-criteria. The potential research outcomes would identify the main trasilient sub-criteria in a unified framework. It is expected to determine the performance of each vendor towards the defined criteria and sub-criteria aiming to rank them from 1 to 7. Subsequently, decision makers will easily determine the best proposed tender to implement the RFID-based passport tracking system. Finally, the proposed tool would has a potential trend to solve similar supplier or vendor selection problems.

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AHP-FTOPSIS approach for a green and resilient supplier selection and order allocation: A real case study

[1*]Ahmed Mohammed, [1]Irina Harris, and [2]Reda Nujoom

[1]Cardiff Business School, Cardiff University, Aberconway Building, Colum Dr, Cardiff, UK CF10 3EU
[2]School of Engineering, University of Portsmouth, Portsmouth, UK PO1 3DJ

Ece80495@myport.ac.uk

Abstract

This paper presents an approach to solve a supplier selection and order allocation problem considering traditional, green and resilience (TGR) characteristics. A set of criteria were identified within a unified framework and their relative importance weighted using the AHP algorithm. In addition, the suppliers were evaluated and ranked based on their performance towards the identified TGR criteria using the FTOPSIS algorithm. The obtained weights from are then to be integrated into a multi-objective programming model to be developed to obtain an order allocation plan towards the minimization of total cost and CO_2 emissions and maximization of TGR purchasing value.

Keywords: Supplier selection; Green development; Supply chain resilience.

Submission category: working paper

Introduction

The supplier selection and order allocation decision-making process represents a key activity in supply chain management since purchasing expenses exceed fifty percent of all firms' costs. Despite the importance of price, other evaluation criteria should be considered such as reliable delivery, which will ultimately effect productivity and efficiency within a production environment and therefore overall costs.

Presently, there are ever increasing responsibilities placed on companies to consider the environmental impact of their supply chain activities (Mohammed et al., 2017). Green supply chain management is the activity of purchasing, producing, marketing and performing various packaging and logistical activities that takes into account environmental implications (Sarkis, 1999). Kuo and Lin (2011) proposed an integrated approach using ANP and DEA for green

supplier evaluation. Akman (2015) suggested a two-step supplier-assessment framework to evaluate green suppliers. Purchasing managers may consider traditional and more recently green criteria when assessing suppliers while neglecting resilience. Resilience is the capability of the system to efficiently adapt an expected disruptions and back to its normal process, is a vital aspect of any supply chain management (Torabi et al., 2015). Recently, hurricane Sandy led to massive disruptions in US supply chains (Torabi et al., 2015; Burnson, 30 Oct 2012). To protect their business, purchasing managers should include resilience in to their decision-making criteria (Torabi et al., 2015). Pramanik et al. (2016) presented a fuzzy MCDM approach as an aid to developing a resilient supplier selection activity. Sawik (2013) designed a mixed-integer programming model to solve a supplier selection problem in a supply chain under disruption risks.

Since additional criteria, such as environmental sustainability and resilience are paramount to building a successful and competitive supply chain, supplier selection complexity has increased. A new approach is required, which incorporates three main criteria: traditional business, green and resilience. Despite the significant quantity of research already conducted around these topics, the vast majority of current literature considers the green and resilience aspects of supplier selection and order allocation independently.

This paper presents an approach for evaluating and ranking suppliers with respect to their traditional, green and resilience (TGR) characteristics and then order the right quantity of products from the right supplier. A set of criteria/sub-criteria were identified within a unified framework and their relative importance weighted using the analytical hierarchy process (AHP) algorithm. In addition, the suppliers were evaluated and ranked based on their performance towards the identified TGR criteria using the fuzzy technique for order of preference by similarity to ideal solution (FTOPSIS) algorithm. The obtained weights from AHPA and FTOPSIS are then to be integrated into a multi-objective programming model to be developed to obtain an order allocation plan that can help decision makers to order the optimal quantity of material from suppliers towards the minimization of total cost and CO2 emissions and maximization of TGR purchasing value. The applicability and effectiveness of the proposed approach is proved through a real case study by revealing a comparatively meaningful ranking of suppliers. The study provides a noteworthy aid to management who understand the necessity of building supply chain resilience while concurrently pursuing ‘go green’ responsibilities.

The supplier selection and order allocation approach

A laboratory instrumentation Original Equipment Manufacturer wants to develop a resilient supplier selection approach for evaluating their current suppliers in order to plan for unexpected events. Additionally, the company is keen to take ownership of their environmental responsibilities. This research supports the company's requirements through development of a supplier selection approach to facilitate evaluation and ranking of suppliers based on their performance with respect to traditional, green and resilience criteria. The traditional sub-criteria (TC1-TC7) include: cost, quality, delivery reliability, performance history, turnover, lead time, and operating capacity. The green sub-criteria (GC1-GC3) include: environmental management system, waste management and environment related certificate. The resilience sub-criteria (RC1-RC5) include: flexibility, leanness, agility, robustness and visibility (FLARV). AHP used linguistic expert assessment to determine the importance weight for each criteria and sub-criteria based on the evaluation scale presented in Table 1. FTOPSIS was then adapted towards evaluating suppliers based on their performance towards the criteria shown in Figure 1 using the evaluation scale presented in Table 2. Subsequently, the ranking order of suppliers was determined based on evaluation derived from FTOPSIS.

AHP

AHP is a multi-criteria decision making algorithm developed for considering both qualitative and quantitative aspects of decisions (Saaty, 1977). It aims to analyse the complex decisions to a series of pairwise comparisons and then reveals the final weight. In this work, AHP was applied to determine the importance weight for each TGR criteria and sub-criteria and Table 2 shows the evaluation scale in terms of linguistic variables that were used to perform pairwise comparisons. Decision makers need to give their opinion regarding the importance of each criteria / sub-criteria with respect to the others. In this work, AHP was implemented as follows:

1. Use decision makers' preferences to build a pair-wise comparison matrix (A) using the evaluation scale shown in Table 2:

$$A = \begin{bmatrix} 1 & a_{1,2} & a_{1,j} \\ a_{2,1} & 1 & a_{2,j} \\ \dots & \dots & \dots \\ a_{i,1} & a_{i,2} & 1 \end{bmatrix}; \; i = 1, 2, 3, \dots, I; \; j = 1, 2, 3, \dots, J$$

where I and J refers to the criteria.

2. Sum each column of A as follows:

$$Column\ S_i = \sum_{j \in J} a_{ij}, \tag{1}$$

3. Build the normalised decision matrix (R) by dividing each value in matrix A by the sum of its column:

$$R = \frac{A}{Column\ \mathrm{S}_i} \tag{2}$$

4. Determine the weight w_j of each criterion by calculating the average of its weight with respect to other criteria:

$$w_i = \frac{\sum_{i=1}^{I} rowS_i}{J} \tag{3}$$

Table 1. Evaluation scale of criteria in linguistic variables

Scale	Linguistic Variable
1	Equally important (EI)
3	Weakly important (WI)
5	Strongly more important (SMI)
7	Very strongly important (VSI)
9	Extremely important (EI)

TOPSIS

Hwang and Yoon (1981) developed TOPSIS to select an alternative based on its distance to the ideal solution and the negative ideal solution. In this work, TOPSIS was applied to evaluate and rank suppliers with respect to their TGR performance. The linguistic variables previously presented in Table 3 were used to evaluate suppliers towards each criterion. Decision makers need to give their opinions about the performance of every supplier based on their TGR performance. TOPSIS was implemented as follows:

Eq. (8) is used to normalise the decision matrix to get the normalised decision matrix (R):

$$R = \left[r_{ij} \right]_{nxm} \tag{4}$$

where

$$r_{ij} = \left(\frac{a_{ij}}{\sqrt{\sum_i a_{ij}^2}} \right) \tag{5}$$

The weight of criteria (w_j) obtained from the AHP approach should be multiplied by the elements of the normalised decision matrix (R) to form the weighted normalised decision matrix (V).

$$V = \left[v_{ij} \right]_{i*j} \tag{6}$$

where v_{ij} is obtained using the following equation:

$$v_{ij} = r_{ij} \; x \; w_j \tag{7}$$

The positive and negative ideal solutions are determined using Eqs. 11 and 12, respectively (Roy et al., 2004).

$$A^{+} = \left\{ v_1^{+}, v_2^{+}, \ldots, v_n^{+} \right\} \tag{8}$$

$$A^{-} = \left\{ v_1^{-}, v_2^{-}, \ldots, v_n^{-} \right\} \tag{9}$$

The distance of supplier 'I' from the positive ideal solution (d_i^+) and the negative ideal solution (d_i^-) are calculated as follows:

$$d_i^+ = \sum_{j \in n} d_v \left(v_{ij}, v_j^+ \right); \; d_i^- = \sum_{j \in n} d_v \left(v_{ij}, v_j^- \right); \tag{10}$$

where v_j^+ and v_j^- are positive and negative ideal points for criterion 'j', respectively.

Based on d_i^+ and d_i^-, the closeness coefficient (CC) for each supplier is then determined using Eq. 14. The supplier with the highest CC (varies between 0 and 1) is selected as the best green and resilient supplier.

$$CC = \frac{d_i^-}{d_i^+ + d_i^-} \tag{11}$$

Table 2. Linguistic variables and their TFN used for evaluating suppliers

Linguistic variable	Triangular fuzzy number
Very low (VL)	(1, 1, 3)
Low (L)	(1, 3, 5)
Medium (M)	(3, 5, 7)
High (H)	(5, 7, 9)
Very high (VH)	(7, 9, 9)

The multi-objective model

A new multi-objective programming model to be developed to solve the order allocation problem. It is used to support decision makers to order the optimal quantity of products from suppliers considering TGR aspects. Three objective functions were formulated: minimization of related costs (RC), environmental impact and maximization of resilience purchasing.

Application: a real case study

To validate the applicability and effectiveness of the developed methodology, it was applied with a manufacturing company (Company A, henceforth) that design and produce thermal desorption and time-of-flight mass spectrometry instrumentation in the UK.

The purchasing manager (PM) was invited to select a number of suppliers to validate the proposed approach in evaluating their performance towards the identified criteria illustrated in Figure 1. The PM has more than 18 years procurement experience. Two deep discussions (each about 2 hours) were held to explain, discuss and evaluate the TGR criteria, sub criteria and five suppliers' (S) performance.

Weighting TGR criteria

In this step, AHP was implemented to determine the importance weight for each TGR criteria and sub-criteria. Thus, the PM was invited to perform a pairwise comparison among TGC criteria and sub-criteria using the linguistic variables presented in Table 1. AHP is applied to determine the importance weights of each criteria and sub-criteria which are presented in Table 3. According to the calculations shown in Table 4, the weight of traditional criteria is 0.263293; the weight of green criteria is 0.051821; and the weight of resilience criteria is 0.684886. The resilience criteria obtained the highest weight followed by the traditional and then green pillar.

Thus, the resilience criteria are deemed to be the most important compared with the other traditional and green criteria. The PM confirmed that the company's current strategy was to build a resilient supply chain rather than selecting suppliers according to performance towards traditional criteria such as costs and quality.

Table 3. Weights of TGR criteria and sub-criteria obtained by AHP

Criteria	IW	Ranking	Sub-criteria	IW	Ranking
Traditional	0.263293	2	TC1	0.188584	2
			TC2	0.148292	4
			TC3	0.146552	5
			TC4	0.02105	7
			TC5	0.082984	6
			TC6	0.250322	**1**
			TC7	0.162216	3
Green	0.051821	3	GC1	0.481354	1
			GC2	0.282937	2
			GC3	0.235709	3
Resilience	0.684886	1	RC1	0.033343	5
			RC2	0.192122	3
			RC3	0.093336	4
			RC4	0.429723	1
			RC5	0.251476	2

Ranking suppliers

After determining the importance for each TGR criterion, fuzzy TOPSIS was implemented to obtain the ranking order of suppliers based on their TGR performance. The PM was invited for another interview to evaluate the performance of selected suppliers with respect to each sub-criterion using the evaluation scale presented in Table 1. Table 4 shows the performance evaluation and rank of suppliers with respect to each TGR criterion. According to the obtained results, S_2 revealed the highest TGR performance with a closeness coefficient of 0.89373.

Comparing with the other suppliers the closeness coefficient of S_4 (0.733641), S_2 (0.489352), S_5 (0.432518) and S_3 (0.117511) were respectively in rank after S_1.

Table 4. Closeness coefficient and distances from the positive ideal/negative ideal solutions related to suppliers

	S_1	S_2	S_3	S_4	S_5
D_i^+	0.008212	0.008212	0.068047	0.023736	0.042167
D_i^-	0.069065	0.069065	0.009061	0.065376	0.032138
CC	0.89373	0.489352	0.117511	0.733641	0.432518
rank	1	3	5	2	4

The Order allocation plan

In this section, we expect to end up with an optimal order allocation of products among the five suppliers according to (1) their performance and (2) a number of objectives (i.e., minimum total cost and CO2 emissions and maximum TGR purchasing value).

Conclusions

This work presents a unified traditional business, green and resilient supplier selection and order allocation approach. The framework was developed by identifying traditional, green and resilience criteria and sub-criteria. Two steps were followed to evaluate and rank suppliers. Firstly, AHP was applied to determine the importance weight of each criterion and sub-criterion based on the linguistic evaluation of a purchasing manager. The AHP results indicate that the resilience criteria are deemed the most important for company A, followed by traditional and green, respectively. Secondly, fuzzy TOPSIS was applied to reveal the order ranking of suppliers based on their TGR performance with respect to the importance weight of each criterion and sub-criterion. Currently, a multi-objective programming model is being developed to solve the order allocation problem incorporating weights of TGR criteria and suppliers obtained from AHP and FTOPSIS respectively. Based on the obtained suppliers' performance, we recommended that company A works with some of their suppliers (e.g. S_3 and S_5) to improve their resilience. The results demonstrate the applicability of the novel approach in assisting the purchasing manager at company A to produce a green and resilient purchasing strategy through supplier evaluation.

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The dynamics of reshoring decision-making initiatives: which role for the purchasing department?

Antonella Moretto
School of Management, Politecnico di Milano, Via Lambruschini 4/B, Milan, Italy
Andrea Patrucco
Penn State University, Department of Business, PA, USA

Abstract
Literature is rich in the identification of different meanings and decisions about reshoring as well as in listing the main drivers for reshoring. Few contributions try to make a link between these two areas, identifying drivers for specific reshoring decisions. Literature highlights the importance to investigate the decision-making process and in this vein procurement department is mentioned as a key actor to involve in the process. Nevertheless, the involvement of purchasing along reshoring processes is still unexplored. Through 25 case studies, the link between reshoring decisions and drivers was hint and four patterns of involvement of procurement along the decision-making process identified.

Keywords: Reshoring decisions; reshoring drivers; procurement

Research background and motivations
Production offshoring has been one of the most diffused and effective strategies pursued by international companies in the last twenty years (Ferdows, 1997; Kedia and Mukherjee, 2009; Silveira, 2014). Even though a trend still present today, it cannot be neglected that firms devoted to this practice have start experiencing, during the years, some drawback of these decisions, like changes in the conditions of the local environment (e.g. higher costs, regulation evolution, undesired political issues), supply chain disruptions, and supplier and/or human resources quality problems (Dou and Sarkis, 2010). For these reasons, many organizations are now undertaking an opposite path, by deciding to relocate their facilities in other locations, often near their home country (Fratocchi et al., 2014), realizing the so – called "reshoring" phenomenon, which has caught the attention of many scholars and practitioners in the supply chain field.
Reshoring literature struggles in providing the main definitions of what a reshoring decision actually is. A reshoring initiative is quite simple in its meaning, as it can be interpreted as a location decision (Ellram, 2013; Gray et al., 2013) with the aim to revise a previous offshoring choice, by relocating a part of the production network back to the company's home country ("back-reshoring") or home region ("near-reshoring"), in order to seek new competitive advantages (Fratocchi et al., 2014). In this sense, reshoring can be defined as "*the relocation of value creation tasks from offshore locations to geographically closer locations such as domestic or nearshore countries*" (Foerst et al., 2016, p. 495). This definition entails several basic concepts of a reshoring initiative. First of all, it entails that a reshoring initiative is recognized as a reverse decision of a previous decision to offshore (Tate, 2014); secondly, it can refer to the relocation of all the activities as well as a part of those (Bals et al., 2013); finally, it entails to the possibility to move towards domestic or nearshore countries (i.e. backshoring vs nearshoring; Kinkel and Maloca, 2009). During last years, different interpretation of this have been provided, with some authors arguing reshoring in light of economic variables (such as the reduction

in labor cost differentials between low-cost and western countries and escalating logistics costs; Kinkel, 2014; Tate, 2014), others addressing supply chain issues (such the indirect drawbacks of offshoring: higher risks exposure, higher delivery time, and loss of flexibility; Ellram et al., 2013), and other ones pointing out asset considerations (e.g. intellectual property protection, product quality, brand image; Simchi-Levi et al., 2012; Dachs and Kinkel, 2015). Despite this, while offshoring dynamics have been extensively addressed, a clear definition and view about what is happening when firms decide to reshore, is still missing, despite recent studies have tried to shed more light on the decision-making process (e.g. Tate et al., 2014; Stentoft et al. 2015; Bals et al., 2016).
In this scenario, a problem which still remains crucial is how to manage the supply base location. With the offshoring trend in place, most domestic supply networks evaporated or followed their customers in the new country (Fel and Griette, 2017) - even though with a delay of a few years; similarly, if companies want to return their production facilities back home, they have to consider they will have to rely on a supply base still located in other geographical areas, at least until the economics for the supplier will also drive them to follow the company to the home country (Kinkel and Maloca, 2009).
This has an evident impact on the purchasing strategy decisions, thus making the involvement and the role of the purchasing department in the process crucial. If we look at what has been discussed so far, the contribution of purchasing in this type of company decisions has been addressed with mixed evidence (e.g., Foerst et al., 2016).

Research questions and framework

On these premises, there is space to enlarge contributions, to both theory and practice, in two ways. On one side, it may be interesting to shed more light on the dynamics of the reshoring decision – making process, by defining a comprehensive taxonomy including both reshoring options and drivers. On the other, it is interesting to characterize more in detail the role and contribution of the purchasing department, by analyzing the degree of involvement in this process and the type of expected contribution.

The reshoring decision: drivers and antecedents

If we look at the reshoring literature, we can actually identify two big research areas.
On one side, reshoring drivers have been one of the most recently debated topic. As a matter of fact, several authors have focused their attention on possible classification frameworks of these elements (e.g., Ancarani et al., 2015; Fratocchi et al., 2016).
On the other hand, several authors have tried to design some possible taxonomies to classify the company reshoring decisions (e.g., Bals et al., 2016; Foerst et al., 2016).
However, despite the richness of literature in these two areas, they have always been addressed separately, and a clear link about how to link reshoring options to reshoring motivations is missing (while present for offshoring decisions; e.g. Patrucco et al., 2016).
In light of this identified gap, the first aim of this paper is trying to understand whether some specific reshoring decisions can be driven and explained through specific drivers. Thereby, the first research question is the following:

RQ1: How can reshoring drivers be connected with specific reshoring decisions?

Being drivers the point of start, we have first tried to integrate the different contributions found in the literature; as a reference point, we consider the review made by Di Mauro et al. (2017), which distinguishes drivers in different categories, and provides a univocal definition. In defining the reshoring taxonomy instead, we decide to adopt a specific framework, that proposed by Foerst et al., 2016 (in turn, adapted from Contractor et al., 2010; Jahns et al., 2016), which discriminates reshoring decisions in light of two

dimensions: location (i.e. if the company is bringing operations back to the home country or near the home country) and ownership (i.e. if the company is changing the way these operations are controlled) of the activities. In light of these two variables, authors distinguish reshoring typology being: mono-dimensional driven, if the company is modifying the ownership (i.e., domestic insourcing, nearshore insourcing, offshore insourcing) or the location (i.e., outsourced backshoring, outsourced nearshoring, in-house nearshoring, in-house backshoring); bi-dimensional driven if the company is modifying both the ownership and the location (i.e., nearshore insourcing, backshore insourcing).

The role of purchasing

According to Bals et al. (2016), when managing the reshoring decision-making process, managers pass through three sequential stages: 1) ex ante activities, which involve evaluation of the feasibility of the decision; 2) activities to take the reshoring decisions, which involve the design of the reshoring decision (i.e. information gathering on alternatives; data analysis; development of the solution; selection of the sourcing option); 3) implementation activities, which involve the practical realization of the reshoring decision. In the past, scholars have discussed several contingent variables that can impact the dynamics of this decision-making process - e.g., country level factors (e.g., Dunning, 2000; Ellram et al., 2013); firm – specific factors (e.g., Sun et al., 2012; Macchion et al., 2015); decision impact factors (e.g., Kinkel, 2014); surprisingly, even though reshoring decisions imply reconfiguration of the supply chain and, in particular, of the supply network (Van den Bossche et al., 2014), a focus on the role the purchasing department should play in this process is missing. The strategic role of the purchasing in companies has been promoted so far (Spekman, 1988; Ellram and Carr, 1994; Brandon-Jones and Knoppen, 2017). As a strategic function, purchasing can actually play a proactive role in pursuing firm's goals with a long-term focus (Carr and Pearson, 1999; Carr and Pearson, 2002; Tchokogué et al., 2017), as well as when involved in strategic decision-making processes, such as the reshoring one (Gonzalez-Benito, 2007).

The second objective of the paper is thus to explore, more in detail, which are the conditions that lead to purchasing involvement, and the contribution purchasing can give to the reshoring dilemma when timely involved. Thereby, the second research question is the following:

RQ2: When is the procurement department involved in the reshoring decision-making process?

As a matter of fact, the involvement of procurement within strategic decisions is more likely to happen when purchasing is promoted as a strategic function in the organization (Ates et al., 2018). In order to discriminate the different levels of purchasing strategic relevance of procurement for a company, the model proposed by Paulraj et al. (2006) was adopted, which measures these aspects across three dimensions: 1) strategic focus, i.e. extent to which purchasing objectives are focused on long-term opportunities; 2) strategic involvement, i.e. extent to which purchasing people and activities are connected to company strategic planning processes; 3) purchasing recognition, i.e. extent to which purchasing people and competences are perceived as value – adding by top management and other departments.

Research methodology

As presented, the study is exploratory in its nature; for this reason, a multiple case study approach was selected, also because often used for analyzing offshoring and reshoring dynamics (e.g. Mudambi and Venzin, 2010; Di Mauro et al., 2017; Johansson and Olhager, 2018). This method is appropriate as a way to describe phenomena in real context (Voss et al., 2002) being able to provide in-depth comprehension of the unit of analysis, although limited in terms of standardization and generalization of results (Larsson and Lubatkin 2001). To define the sample, we first scout secondary sources (Cowton, 1998), and identify more than 100 companies mentioned in news as having performed reshoring initiatives in the last years; we then analyze in-depth information available about each initiative, in order to understand if this would have been useful for the purpose. If this was not evident from secondary sources, preliminary calls were performed to understand more in detail the main features of the initiative and to understand if the company was potentially valuable to be involved in the research.

This screening process lead to the identification of 25 suitable reshoring initiatives, referring to 18 different companies. On one side, these 18 companies can be considered useful for the purposes, being heterogeneous per country of origin, industry, and turnover; on the other hand, the 25 reshoring initiatives are homogeneous for focus on the reshoring initiatives. Being the research questions project – specific, our unit of analysis has been the reshoring initiative, so we can represent our sample as described in *Table 1*.

Table 1. Sample of analysis

Case	Industry	Turnover 2016	Employees 2016	Home country
Tractor	Automotive	390 Million €	1.234	Italy
Child 1	Pharmaceuticals	581 Million €	1.700	Italy
Child 2				
Shirt	Apparel	9 Million €	77	Italy
Travel luggage	Leather goods	39 Million €	112	Italy
Automotive	Automotive	113 Billion €	230.000	Italy
Work luggage	Leather goods	60 Million €	267	Italy
Knitwear 1	Apparel	73 Million €	379	Italy
Knitwear 2				
Trousers	Apparel	7 Million €	13	Italy
Elevators	Transport systems	9 Billion €	50.000	US
Sport shoes 1	Sportswear	74 Million €	173	Italy
Sport shoes 2				
Sport shoes 3				
Sport shoes 4				
Casual shoes	Apparel	39 Million €	n.a.	US
Sitting room	Furniture	437 Million €	2.232	Italy
Home appliances	Home appliance	5 Million €	38	Italy
Jackets 1	Apparel	47 Million €	125	Italy
Jackets 2				
Jackets 3				
Ski pole	Ski pole	1 Million €	5	US
Electric bikes	Bicycle	23 Million €	n.a.	Italy
Washing machine	Home appliance	5 Billion €	100.000	US
Formal suit	Apparel	1.3 Billion €	7.000	Italy

For each initiative, data were collected during 2016 and 2017 through direct interviews (from a minimum of 2 to a maximum of 5 for each project). Interviews were realized face-to-face (when possible) or through virtual meetings; each one involved at least two

researchers, in order to compare perceptions and avoid bias. Managers interviewed were Chief Purchasing Officer (CPO), Chief Executive Officer (CEO), Supply Chain Manager, Vice President, Production Managers, General Managers, etc. To avoid information loss, notes taken by researchers and interview recording (upon permission) were used. moreover, researchers take notes during the interviews.

Interviews were carried on following a semi-structured interview protocol. After the interviews, data were coded and shared with the company, to cross check everything was properly understood; in case something needed to be change, or missing information, e-mail or virtual meeting follow – up were used.

More, data collected through the interviews were always triangulated with other secondary sources - newspapers, websites, additional documents provided by the companies, presentation of the reshoring initiative in conferences or workshop. In some cases, interviews with trade associations (e.g., Assocalzaturifici – Italian association of shoe manufacturers; Sistema Moda Italia – Italian association of fashion companies; Founder of the Reshoring Initiative; Unindustria Como – Italian association of companies in the area of Como) were also performed to double check information.

Results and case discussion

The link between drivers and reshoring initiatives

The cross-case analysis on reshoring decision – making variables (i.e. direction of change, reshoring scope and type, driver typology) first shows that, for all the driver categories included in the framework, there is a correspondence in our sample, thus confirming that existing theoretical classification are consistent with the main motivations driving companies towards reshoring. We can observer that, among the different drivers, operational reasons and brand reputation aspects are the most claimed according to our sample; this result is consistent empirical evidence provided by other authors (e.g. Frattocchi et al., 2016), but may be strongly related to sample features. As a matter of fact, most of the reshoring initiatives involves moving from East or far East countries to Italy, with the main motivations to partially recover partial the Italian "made in effect", or to a stem increase of the overall costs, which are reducing the economic advantage bringing companies to offshore in the past. Another key factor is represented by the need to move operations close home country-based R&D activities: consistently with what promoted in the innovation field (e.g. Carrincazeaux, 2001), a strong proximity between innovation activities and operations department is fundamental to improve innovation performance and to reduce the overall time-to-market. So, the shorter the lifecycle of products (in combination with previous drivers), the higher is the need to accelerate product launch on the market, which has pushed companies to revise previous offshoring decisions (and less geographical distance).

Immediately after this, the risk reduction represents another relevant motivational factor for reshoring initiatives: several companies are either worried about fluctuation in currency exchange, or about specific supply chain risk (e.g. supply interruption or quality risk). Thereby, the choice to relocate their activities in the home country (or in a closer one) are linked to the broader supply chain strategy to reduce risk; this result, as well, is consistent with that part of literature demonstrating how global supply chains have more risk sources to deal with (e.g. Manuj and Mentzer, 2008).

Just a few companies mentioned instead organizational or government policy drivers.

Organizational factors have been mentioned essentially referring to the search for availability of qualified workers, who have demonstrated to be not as skilled as expected in the offshored countries, thus created technical and qualitative issues for companies.

Government factors are essentially embedded in tax incentives to rebuild local supply chains; this driver was particularly mentioned by companies headquartered in US and Switzerland, where tax incentives may give massive advantages when promoted by governments (Tate, 2014).

Each case was also analyzed in light of the reshoring scope, in order to understand whether the reshoring decision implied a bi or mono – dimensional change: as a matter of fact, for our sample, besides two cases (tractor and home appliances), only partial reshoring initiatives were involved. The fact that companies usually focus either on the location or the ownership can be interpreted in two ways.

On one hand, given that reshoring decisions already have a significant magnitude, companies try to smooth the risk associated to the initiative and by acting just on one of the reshoring dimension. In particular, in our sample, most of the companies tend to focus first on the dynamics of changing the location, despite revolutionizing the ownership too. At this regard, the Procurement Manager in the Tractor case said: *"In our company, we tend to separate reshoring decisions in terms of location change, and aspects linked to the ownership (…) We change make-or-buy choices too, but these usually don't strictly depend on the location where these activities are performed. (…) When we decided to bring production back from France to Italy, we did it because we feel we were losing the "Made in Italy" effect which has a value also for our industry (…) why we still rely on suppliers rather than managing activities internally is a totally different issue"*. This result is not completely aligned with existing literature (e.g. Bals et al., 2015; Foerst et al., 2016), which instead used to promote these choices as in synergy.

On the other side, if we look at the six cases that performed a bi-dimensional change (e.g. Child for both the reshoring initiatives), they all involve a change from outsourcing to insourcing of operations driven by the need to increase the level of control on these activities. As a matter of fact, companies discovered that outsourcing of production to a third part was not the best make-or-buy decision, and so take the opportunity of the relocation to reverse this choice. In the Child case, the CPO affirms: *"In the past, we decided to move our production activities to China mainly for cost reasons. After a while, not only labor cost in China started increasing, but we also started facing several unexpected challenges, such as the inability to be flexible to customer requirements, to quickly react to market request keeping lead time short, to limit the risk of suppliers start copying our products (…) Having plants with production capacity available, that's why we decided to take back those activities, in-housing them partially in Italy and partially in Romania"*. This is aligned with previous results, discussing on insourcing as being driven mainly by need of higher control and risk reduction factors (e.g. Hartman et al., 2017; Hartman and Ogden, 2017).

Finally, cross – case analysis allows us to understand if it is possible to identify some recurring patterns between drivers and reshoring decisions. *Table 2* reports main results.

Table 2. Link between drivers and reshoring initiatives

Reshoring scope	Reshoring type	Driver classification	Cases
Bi-dimensional change	• Backshore insourcing • Nearshore insourcing	• Operational drivers (operational flexibility) • Organizational drivers (availability of qualified workers) • Brand reputation (Made in effect)	Child 1 Child 2 Travel luggage Trousers Home appliances Electric bikes
Mono-dimensional change	• In-house nearshoring	• Cost drivers (labour cost; logistics cost) • Risk (currency exchange)	Work luggage Knitwear 1 Sport shoes 1

	• Outsourced nearshoring		Jackets 2
Mono-dimensional change	• Outsourced backshoring	• Operational drivers (lead time reduction; operational flexibility) • Brand reputation (Romania and Turkey)	Shirt Knitwear 2 Sport shoes 2 Sport shoes 3 Sport shoes 4 Casual shoes Jackets 1 Jackets 3 Ski pole
Mono-dimensional change	• In-house backshoring	• Brand reputation (Made in effect) • Operational (Proximity to the home base R&D) • Governmental (Tax incentives)	Tractor Automotive Elevators Sitting room Washing machine Formal suit

We are able to identify four main recurring patterns linking reshoring decisions driven and drivers. The first one involves bi-dimensional change reshoring: for all the six cases (although limited in number) drivers are quite similar, with most relevant motivations represented by the desire to regain control along the chain, to improve brand reputation as well as to improve operational flexibility. Also, the possibility to rely on their own qualified workers in the local area (compared to lower competences available in the offshore location) pushed companies to the decision of insourcing activities either in their home country or at least in nearest one. As cases reported, this choice is often perceived away to revert a previous choice, once realized desired results were not achieved. Of course, these results need to be interpreted also in light of some sample-specific factors, like the fact the cases in this group all refer to companies located in Italy and realizing a product were the "Made in Italy" factor is crucial (e.g., home appliances, clothes, etc.), making drivers and the possible need to reverse previous radical supply chain decisions in line with these characteristics. The situation is instead more complex if we analyse mono-dimensional change reshoring.

A second pattern can be identified for nearshoring initiative (either insourced or outsourced). In our sample, four initiatives decided to adopt this strategy, mainly with the aim to reduce either costs or risks. For the former, labour cost, logistic cost (e.g. from Romania) and quality control efforts were the main factors mentioned to push companies to relocate production activities closer. For the latter, several cases highlighted the impact that currency exchange volatility can have on economic performance, thus driving the need to move activities in countries with the same currency (e.g., euros). All those companies operate in labour intensive industries, where labour costs have a relevant incidence, and mainly realize functional products (i.e., work luggage, sport shoes, jackets), for which quality is relevant, but also cost remains a key parameter, and the "Made in" effect is not so impacting.

The third pattern refers to outsourced backshoring. This is the most diffused archetype, mainly driven by lead time reduction and need for stronger flexibility. It involves company operating in very volatile industries (e.g., fashion), where the ability to respond quickly and reactively to market request is crucial, thus justifying the outsourcing option. However, the brand reputation effect is fundamental as well, especially in case operations are backshored from countries closed to Italy (e.g., Romania and Turkey). In these cases, the cases mentioned explicitly as driver the importance to recover the Made in Effect.

Finally, the fourth pattern refers to companies realizing in-house backshoring. Consistently with literature ownership and location as both key variables to be considered

in reshoring decision making (e.g. Van den Bossche et al., 2014; Foerstl et al., 2016), this archetype presents different drivers if compared to previous ones. Although brand reputation is still present, it now has more widespread features: companies can use the reshoring initiative as an advertising element to promote their local image, presenting this choice as a byword for quality as well. Operational drivers are relevant as well, but they mainly relate to the need of increasing R&D proximity to operations, thus fostering collaborations and sharing of ideas (Carrincazeaux et al., 2001). Finally, it is only for this case that governmental policy driver seems to be key element: as a matter of fact, governments provide tax provisions only if companies directly control the operational activities, and so keeping control of operations in-house is a key choice.

The role of procurement department in decision-making process

Cross-case analysis (see *Table 3*) highlights that most of the companies are involving procurement department in the feasibility phase, although with different responsibilities (e.g., verifying cost and time constraints; evaluating broader perspectives for the supply base; measuring potential advantages). Several companies are also involving the procurement department in the implementation phase, especially when reshape of the supply base is necessary; in this case as well, the involvement may occur at different levels (e.g., redesigning the supply base; managing critical supplier relationships; participating to complex negotiation activities; renewing the relationships with suppliers, etc.). On the contrary, most of the companies are actually not involving procurement department as fare as reshoring planning activities are involved: just the Child and Trousers cases actively involved procurement department in data analysis and decision, while the Automotive company consulted procurement department before finalizing the reshoring configuration. Through the cross-case analysis, four types of involvement of procurement department in the reshoring initiative have been identified (*Table 4*).

Table 3. Patterns of involvement of procurement department in decision-making process

	Involvement in feasibility	**Involvement in decision plan**	**Involvement in the implementation**	**Companies**
No involvement	Not involved	Not involved	Not involved	Sport shoes Formal suit
Operational involvement	Not involved	Not involved	Redesign the supply base; Managing relationships with suppliers	Tractor Shirt Travel luggage Work luggage Knitwear Ski pol Electric bikes
Early involvement	Verifying cost and time constraints; Evaluating impacts on the supply base	Not involved	Redesign the supply base; Managing relationships with suppliers	Automotive Elevators Casual shoes Sitting room Home appliances Jackets Washing machine
Strategic involvement	Verifying cost and time constraints; Evaluating implications on the supply base	Data analysis and reshoring type decision	Redesign the supply base; Managing relationships with suppliers	Child Trousers

The four options differ in terms of phases in which procurement department is involved. We step from no involvement at all in the decision – making, passing through an operational involvement (just limited to implementation activities), an early involvement (when consultation occurs in the feasibility phase), to arrive to a full strategic involvement, where purchasing can act as real promoter of the reshoring decision.

These four involvement options can be read in light of the strategic relevance of the department within the company (*Table 4*).

Table 4. Patterns of involvement of purchasing department on the basis of strategic relevance of procurement

	Strategic involvement in company planning processes	***Strategic focus***	***Recognition within top management***
No involvement	Not involved	Short term	Low recognition
Operational involvement	Not involved	Short term	Low/good recognition
Early involvement	Involved	Long term	Low/Good recognition
Strategic involvement	Involved	Long term	Low/Good recognition

Empirical evidence show that recognition is apparently not a key variable to discriminate among the four types of involvement as, the three models giving purchasing a role in the reshoring decision-making see a balance between cases with low and good level of recognition. This is not surprising as, in many company, purchasing departments are still struggling in being recognized as equal partners by the organization, without this meaning they cannot have a role in strategic decisions (Luzzini and Ronchi, 2016).

Beyond that, both strategic involvement and strategic focus appears potentially valuable, consistently with existing literature (Paulraj et al., 2006).

On the other hand, case studies address that strategic relevance of procurement (measured in terms of strategic involvement, strategic focus and recognition within top management) is just partially discriminating among different levels of procurement in decision-making process, not differentiating all the four archetypes. In case the strategic relevance of procurement is low (i.e., low strategic involvement and low strategic focus), the two models either without any involvement of procurement or procurement with a mere operational role is pursuable; on the contrary, in case of a high strategic relevance of procurement (i.e., high strategic involvement and high strategic focus), the company can select between an involvement in data analysis as well as operational support or along all the process. This result is quite aligned with existing literature about strategic relevance of procurement: it is definitively necessary to assure the recognition within the company and by other departments of the strategic importance of procurement to assure an in-depth involvement in strategic decisions (Luzzini et al., 2014). On the other hand, this result extends existing literature about strategic relevance of procurement, demonstrating that is going beyond the implementation of strategic practices but also entails the involvement in key decision-making processes.

Conclusions and future developments

Being reshoring a phenomenon which is characterizing companies in different industries, this paper aims to address this trend in two ways. On one side, literature has deeply investigated which are main drivers for reshoring initiatives (Fratocchi et al., 2014; 2016), together with the definition of taxonomies for different typologies of reshoring initiatives (Foerstl et al., 2016); whereas, the link between these two streams is missing, thus representing a first open issue to be explored. Secondly, previous research addressed

the importance to look at reshoring as a process (Bals et al., 2013) thus making the organizational perspective an interesting area of investigation. In this vein, a relevant perspective is that of the purchasing department, consistently with the fact that supply base location is a key aspect of offshoring/reshoring (Van den Bossche, 2014), and with the consolidated debate about the strategic relevance of purchasing for company success. In this perspective, it seems interesting to investigate the involvement of purchasing along the reshoring decision-making process, and the strategic contribution these professional can give. To tackle these research goals, a case-based methodology was selected, through the conduction of multiple interviews in 18 companies, for the analysis of 25 different reshoring initiatives. From this empirical evidence, we are able to identify a link between specific reshoring drivers and four possible reshoring patterns (distinguished by changes in location, ownership or both of them); within this, we also define four type of purchasing involvement in the decision-making process (no involvement, operational involvement, early involvement, strategic involvement), which can be related to the strategic relevance purchasing has for the company. These results provide a contribution for both literature and for practice. From a theoretical perspective, this paper first enlarges reshoring literature by adding strong empirical-based evidence to the current most conceptual – based research (Foerst et al., 2016), which can indirectly be strengthen. Moreover, the paper links together drivers and reshoring initiative typologies, an area which is currently under-investigated. Finally, the paper shed light on the role that purchasing can have in this type of decision, thus contributing to bot reshoring and purchasing literature: This last contribution enlarges both research in reshoring and procurement area: for the former, we discuss the organizational impact and the potential contribution that a new department (not considered in previous literature) can give to the reshoring decision-making process; for the latter, the paper defines a new area where purchasing can demonstrate its strategic relevance for companies.

From a practical perspective, the paper provides some contribution as well. As a matter of fact, reshoring is a hot topic for managers, on top of the supply chain management agenda; managers can first use the drivers – reshoring framework to evaluate which reshoring decisions is most suitable for their companies when certain conditions are present. Then, they can rely on an appropriate model to evaluate the importance to involve purchasing in different phases of the decision-making process. As a matter of fact, this paper also has some limitations, representing further opportunities for future research. First, patterns identified are based on a qualitative sample, thus limiting the level of generalizability of results; further research might validate identified patterns through a statistical sample. Secondly, data were collected in 2016/2017, quite close to the period of implementation of the reshoring initiative. For this reason, quantify performance obtained from the reshoring initiative was not possible: adopting a longitudinal perspective, further research might define specific performance metrics to be evaluated for the company during years, in order to discriminate patterns also on the results side.

References upon request

Assessing Suppliers Using Five Factor Model of Personality within a Civil Military Environment

Christodoulos Nikou[a] and Socrates J. Moschuris[b]

[a] Corresponding Author, PhD, Civil Servant, Hellenic MoD, Greece, 4-6 Neurokopiou Street, Papagou, Athens, Greece. Tel. +30 2106563917. E-mail: chrisnikou@gmail.com; cnikou@unipi.gr.

[b]Associate Professor of Logistics and Supply Management, Department of Industrial Management and Technology, School of Maritime and Industrial Studies, University of Piraeus, 80 Karaoli and Dimitriou Street, 18534, Piraeus, Greece. Tel. +30 210 414 23 61; Fax: +30 210 4142342; E-mail: smosx@unipi.gr.

Abstract

Defence budgets tend to decline, thus reforming procurement processes to become apparent in order to maintain efficiency in high levels and Security of Supply (defined in the European Directive 2009/81). The purpose of this article is to suggest a holistic supplier selection approach that combines Five Factor Model (FFM) for Personality traits, with statistical methods under the concept of Civil Military Integration (CMI). It endeavours to provide a flexible and cost-effective approach for supplier selection by adopting a dipole process that addresses to the potential suppliers and in parallel to the team that will perform the section. It may be useful to public procurement managers, but also to private ones, as it combines characteristics from both procurement areas.

Keywords
Five Factor Model, Civil Military Integration, Supplier Selection

Introduction

The economic crisis in Greece led suppliers to exist in a complex and competitive environment mostly due to the fact that a lot of businesses operating in Greece focus on cutting cost, reducing capacities and consolidating suppliers. Those businesses, thriving to stay alive, try to adopt innovative approaches to safe their internal and external procedures of supply chains. Therefore, there is a great need to follow a strong and effective approach that may provide better performance and effectiveness. The defence area could not be an exception of that as it is stated that Military Logistics include,

among others, aspects of military operations that deal with the acquisition of parts, materials and services (DoD 4140.1, 2003; Apte, Rendon and Salmeron, 2011).
The objective of this paper is to present a methodology that is able to identify a supplier by using a tool for explaining personality (FFM) in a frame (CMI) that offers chances of reducing costs. Thus, statistical techniques are used to confront the subjectivity of human thoughts and expressions, factors that stem from our personality. It is applied on FFM, which seems to be a not widely used tool in the supplier selection area (Degraeve, Labro and Roodhooft, 2000; Kannan and Tan, 2002; Hsu, Kannan, Leong and Tan, 2006; Ho, Xu and Dey, 2010; Ware, Singh and Banwet, 2012). For the purpose of this paper, real data were collected through questionnaires of professionals of the private and public sector in Defence and in Health services, services that may be characterized as vital for a state/country/society. The questionnaires were based on the FFM personality trait. To these data, we applied statistical analysis in order to define the characteristics of the desired supplier and of the selection team in a CMI environment.

The paper also demonstrates the fact that FFM, a tool widely used for explaining personality (Schmitt, Allik, McCrae and Benet-Martinez, 2007), may assist in the supplier selection area whereas it turns the interest to a non-greatly lighted area, when examined in parallel with the supplier selection issue, that of the personality characteristics that a supplier selection team should have. It is hoped that the current study will enrich the defence literature by exploring and applying scientific and systematic theories of group decision support and personality theories in the supplier selection problem of the defence area. It combines well-structured and widely used methods with data in a professional area where, to the best of our knowledge, there is still work to be done. To support even better its contribution in the supplier selection area, Table 1 presents the results of a research/review of that area for unrestricted documents, where no combined use of FFM and Regression analysis seems to appear. The paper is organized as follows: In the next section, parts of relevant literature are reviewed and the areas of CMI and FFM are introduced. Then, the phases that comprise the evaluation procedure based on real data are described, and results, conclusions, limitations and directions for future research are discussed.

Literature Review

In this section the results of the relevant literature review are presented. Supplier selection is a Multi Criteria Decision Making (MCDM) issue and it may become the most important decision in procurement. In the literature of procurement, the need for methods/ways to resolve procurement issues has been highlighted (Institute for Security Studies, 2005; Tadelis, 2012). Efficient supplier selection reduces the purchasing costs and improves corporate competitiveness (Ghodsypour and O'Brien, 2001). The relevant literature generally discusses the ways to reach the optimal supplier, the qualitative and quantitative criteria and the trade-offs among them (Degraeve et al., 2000; de Boer, Labro and Morlacchi, 2001; Cheraghi, Dadashzadeh and Subramanian, 2004; Ho et al., 2010; Ware et al., 2012). That literature also demonstrated that no single appropriate approach exists for each supplier selection case, supply managers usually deal with uncertainty and adopt different selection criteria, and there is no statistical analysis regarding the application of a hybrid FFM model in an CMI frame (Degraeve et al., 2000; Lee, Sungo and Kim, 2001; Ho et al., 2010). The supplier selection approaches

mentioned in Table 1 can assist readers who would like to deepen their knowledge in the supplier selection issue.

Supplier Selection Approaches/Methods	
Evaluation -Selection Technique	Authors
Mixed Integer Programming	Ware et al., (2014).
Analytic Hierarchy Process	Al Harbi, (2001);Byun, (2001);Ware et al., (2014).
Case-Based Reasoning	Ng and Skitmore, (1995).
Analytical Network process	Wadhwa and Ravindran, (2007).
Total Cost of Ownership	Degraeve et al., (2000).
Principal Component Analysis	Petroni and Braglia, (2000).
Data Envelopment Analysis	Liu et al (2000).
Optimization Models	Apte et al. (2011).
Statistical Analysis	Verma and Pullman, (1998).
Standardized Unitless Rating Outranking	De Boer et al., (1998).
Methods	Deng et al.,(2014).
Mathematical Models	Sen et al., (2010).
Integrated Fuzzy AHP	Lam et al., (2010).
Fuzzy PCA	Sevkli, (2010).
Integrated AHP and DEA	Kar, (2014).
Integrated AHP and GP	Bottani and Rizzi, (2008).
Integrated Fuzzy and Cluster Analysis	

Five Factor Model Short Overview

Supplier selection may be naturally considered as a decision making process and as such it is affected by aspects of human personality (Dewberry, Juanchich and Narendran, 2013). Jung's typology/Myers-Briggs type indicator has been widely used for investigating personality but it seems to have been criticized over its empirical character, not being tested enough scientifically. Several psychologists are convinced that an accurate representation of trait structure is provided by the FFM and that FFM is the most popular, reliable, and theoretically sound theory of personality due to the fact that it is at the periphery of the public administration literature (Cooper, Knotts, McCord and Johnson, 2013).

FFM is presented as an empirically verified, theoretically sound framework that is widely accepted within the field of psychology and applied by public managers as a tool to assess personalities, while at the same time it is widely accepted for its efficacy (Cooper et al., 2013). In a general frame, FFM is an hierarchical model that explains personality using five broad traits (openness, conscientiousness, extraversion, agreeableness and neuroticism) (Filiz and Battaglio, 2017). These traits are conceptualized as continuous variables with a normal distribution in a population, thus big samples are required to better approach normality hypothesis (Koutrouvelis, 2000). The following table depicts an overview of the five personality traits of the model.

Domain	Definition	Adjective Check List Marker Items
Extraversion/Surgency	The degree to which a person needs attention and social interaction	Quiet, Reserved, Shy vs. Talkative, Assertive, Active
Agreeableness	The degree to which a person needs pleasant and harmonious relations with others	Fault-Finding, Cold, Unfriendly vs. Sympathetic, Kind, Friendly
Conscientiousness	The degree to which a person is willing to comply with conventional rules, norms, and standards	Careless, Disorderly, Frivolous vs. Organized, Thorough, Precise
Neuroticism/Emotional Stability	The degree to which a person experiences the world as threatening and beyond his/her control.	Tense, Anxious, Nervous vs. Stable, Calm, Contented
Intelect/ Openness to Experience	The degree to which a person needs intellectual stimulation, change, and variety.	Commonplace, Narrow-Interest, Simple vs. Wide-Interest, Imaginative, Intelligent

Table 2. The Domains of the Five-Factor Model of Personality

Civil Military Integration Short Overview

CMI is both a driving force in acquisition reform and a product of acquisition reform. It is a concept that advocates bringing together the commercial and military sectors of industry, so both commercial and military work can be performed in a common facility using commercial processes and practices (Acquisition Review Quarterly, 1999). US Government officials and private sector executives have advocated the integration of the defense and commercial sectors (often termed civil-military integration or CMI). The claimed benefits of CMI include cost savings, increased technology transfer, and an increase in the number of potential defense suppliers (US Congress, Office of Technology Assessment, 1994).

A CMI strategy demands extensive modification of acquisition laws and regulations, if not already planned, and concerns over potential costs and risks of such modifications (US Office of Technology Assessment, 1994; Acquisition Review Quarterly, 1999). No ‘’silver bullet’’ policies seem to easily achieve CMI goals and barriers exist that demand a comprehensive (and complex) set of policies. CMI also allows companies to bring together companywide assets and resources that otherwise would be separated by type of work. The resulting efficiencies reduce operating costs and overhead and, in addition, there is an ability to provide the best solutions for commercial and government customers alike.

The Development of the Approach

Theoretical Frame- Restrictions-Assumptions

The number of the questionnaires used as our sample size was 30 (N=30) and constituted the basis for our analysis. That number draws its applicability from the Central Limit Theorem (CLT). CLT synoptically denotes that the sample mean of a large random sample of random variables with mean μ and finite variance σ^2 has

approximately the normal distribution with mean μ and variance σ^2/n (de Groot and Schervish, 2002). A sample may be considered large if $n \geq 30$ (Koutrouvelis, 2000) and consequently the sample size in this study covers the basic prerequisites for CLT to apply statistical analysis.

In our approach, descriptive statistics, regression analysis and correlation coefficient were applied. Regression analysis was used to analyze its importance and the variability of the data of several predictors (independent variables). Regression analysis and its derivatives, regression standards, create quantitative relationships between variables by associating the random observation of dependent variables with given observations of the dependent variable and random errors (Koutras and Euaggelaras, 2010). Also, it showed the determination of the regression accuracy (fit) of the regression model resulting from this process and the possibility of predicting the dependent variable value for known values of the independent variables.

R^2 is the symbol of the coefficient of determination indicating how much variation in the response is explained by the model. The higher the R^2 the better the model fits the data. It takes values between 0 and 1 and expresses the percentage of the total dispersion (the values of the dependent variable) which is explained by the independent variable through the regression line. As a satisfactory standard, it was considered to be with rates of R^2 above 60%, considering that there are several cases in several academic areas where rates of around 50% were considered satisfactory (WWW.BANKOFGREECE.GR, 2011; Mpalopitou and Xatzibaggeli, 2012).

MINITAB statistical software calculates the correlation coefficient for every possible pair and displays p-values for the hypothesis test of the correlation coefficient being zero. The linear correlation coefficient ρ measures the degree of the dependence of 2 variables, i.e. the intensity of the affinity, whether the variables are quantitative or qualitative (Kioxos, 1993). It is noted that correlation generally means that variables are linked to a relationship, but do not necessarily cause causality. In cases where the use of the linear correlation coefficient ρ was necessary, we assumed that, according to Kioxos (1993), although the values of ρ for which the correlation is possible depend on the number of observations, the following indicative values may apply:

a) If $|\rho| \leq 0.3$ then no correlation exists and if $0.3 \leq |\rho| \leq 0.5$ a weak correlation exists.
b) If $0.5 \leq |\rho| \leq 0.7$ an average correlation exists and if $0.7 \leq |\rho| \leq 0.8$ a strong one occurs.
c) $|\rho| \geq 0.8$ equals to a very strong correlation.
d) In addition, the Variance Inflation Factor (VIF) was used for quantifying the severity of multicollinearity and, according to Koutras and Euaggelaras (2010), the following rules are usually applied:
e) if VIF≤10, then the corresponding dependent variable does not have a multicollinearity problem.
f) If VIF> 10 then the corresponding dependent variable has a multicollinearity problem.

Analysis of the Approach

The real data collected were analyzed in order to provide a simple and clear statistical view. Descriptive statistics describe quantitatively the main features of a collection of data and MINITAB produces such descriptive statistics. Table 1 of the

questionnaire (Annex A) presents the ratings, on a Likert 5-scale of importance, of all the desired characteristics that a CMI supplier/manufacturer should have as these have been retrieved from the relevant literature.

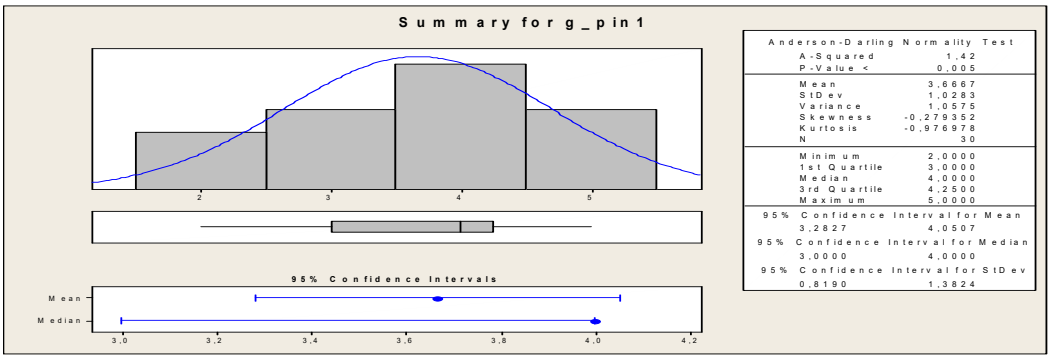

Figure 1.1. Descriptive Statistics for g_pin1

An example to a randomly selected variable of Table 1 (in Annex A) is provided in Figure 1.1. Skewness value of -0.279 indicates that in that distribution the tail on the left side of the probability density function is longer than the right side and the majority of the values lie to the right of the mean. Kurtosis value of -0.97 indicates a platykurtic distribution. 95% Confidence Interval (CI) for sample mean may be used for the calculation of the 95% CI of mean for the g_pin1 variable population (Koutrouvelis, 2000). Comparing the means and its respective CI for Table 1, we reached to the observation that variables d_pin1 (provision of long service commitment) and h_pin1 (ability to adopt commercial best practices) show the highest values. Below-mentioned correlation matrix (Figure 1.2.) describes the MINITAB Pearson Correlation results of Table 1 (in Annex A) where the notable correlations, at a significance level of 0.1, were highlighted.

	a_pin1	b_pin1	c_pin1	d_pin1	e_pin1	f_pin1	g_pin1
b_pin1	0.094						
	0.621						
c_pin1	0.127	**-0.578**					
	0.503	0.001					
d_pin1	0.267	0.232	0.072				
	0.153	0.217	0.707				
e_pin1	0.287	-0.107	0.352	-0.029			
	0.125	0.574	0.056	0.880			
f_pin1	0.125	0.112	0.402	0.318	**0.467**		
	0.512	0.557	0.028	0.087	0.009		
g_pin1	0.031	0.042	0.045	-0.017	0.036	0.055	
	0.872	0.827	0.813	0.928	0.849	0.772	
h_pin1	-0.005	**0.460**	-0.222	0.071	0.042	0.120	0.125
	0.979	0.011	0.237	0.710	0.827	0.527	0.511

Figure 1.2. Pearson Correlation Results for Table 1 of Annex A

Lizarraga, Baquedano, Oliver and Closas (2009) provided the 'Decision-Making Questionnaire' (DMQ) examining the factors that have the most influence on

professional decisions. This questionnaire could guide adolescents in a vocational decision process by calculating the internal consistency of each of the factors using Cronbach alpha coefficient. We selected 6 of these factors that presented the highest score to be evaluated as the desirable features of vendor selection team members in a CMI environment (how important it is for a team member to have this feature). The results of the descriptive statistics showed that the factor "Self-Regulation" had the highest 95% CI for Mean, while on the contrary ''Social Pressure' 'had the lowest respective value for the contrary. Correlation matrix for these 6 factors is depicted in Figure 1.3. where the notable correlations were highlighted.

	TMP	IG	SR	COG	SCP
IG	0.198				
	0.295				
SR	0.180	0.127			
	0.341	0.505			
COG	0.394	0.184	0.084		
	0.031	0.329	0.659		
SCP	0.099	-0.209	**-0.640**	-0.185	
	0.603	0.268	0.000	0.328	
WKP	0.000	0.063	-0.381	-0.173	**0.418**
	1.000	0.742	0.038	0.360	0.021

Figure 1.3. Pearson Correlation Results for Parts 4 to 9 of Table 3 in Annex A

Tables 1 and 2, retrieved from the questionnaire shown in Annex A, depict the frame and provide the raw data where the regression analysis was performed for each one of the Big Five Traits. The persons that filled the questionnaire were asked to rate, on a Likert scale, all the desired characteristics that, according to the relevant literature, a CMI supplier/manufacturer should have. These ratings were linked with the Big Five Traits (BFT) in an attempt to depict the degree of their contribution in the existence of the specific trait to the profile of a CMI supplier. Figure 1.4. shows the results of our interest for a regression analysis performed with the CMI desired characteristics as predictors and the ratings of the BFT as the response.

Conscientiousness

Predictor	T	P	VIF
cons5	2.39	**0.026**	1.3
cons7	2.47	**0.022**	1.5

R-Sq = 60.6%

Analysis of Variance

Source	F	P
Regression	4.05	**0.005**

Agreeableness

Predictor	T	P	VIF
agr1	3.83	**0.001**	1.3
agr3	4.65	**0.000**	2.2
agr4	3.92	**0.001**	1.8
agr6	1.76	**0.094**	2.1
agr8	2.05	**0.053**	2.7

R-Sq = 92.6%

Analysis of Variance

Source	F	P
Regression	32.98	0.001

Extraversion

Predictor	T	P	VIF
ex3	2.05	**0.053**	2.0
ex4	4.48	**0.000**	1.6
ex7	2.34	**0.029**	1.7

R-Sq = 84.0%

Analysis of Variance

Source	F	P
Regression	13.75	0.001

Openness

Predictor	T	P	VIF
op3	2.58	**0.017**	1.6
op4	1.90	**0.072**	1.2
op6	2.19	**0.040**	1.6
op7	2.31	**0.031**	1.7

R-Sq = 72.2%

Analysis of Variance

Source	F	P
Regression	6.82	0.001

Neuroticism

Predictor	T	P	VIF
nr1	4.33	**0.000**	2.0
nr3	2.16	**0.042**	2.1
nr4	2.44	**0.023**	1.7
nr5	2.12	**0.046**	2.1

R-Sq = 92.8%

Analysis of Variance

Source	F	P
Regression	33.75	0.001

Figure 1.4. BFT Regression Analysis

Discussion and Managerial Implications

Descriptive statistics of Figure 1.2. revealed that provision of long service commitment and the ability to adopt commercial best practices were the most highly rated, regardless of the nature of the work of people that rated them (public or private sector in Defense and in Health services). This leads us to the conclusion that the uncertain economic environment is now a factor that is often and seriously taken into account and created the need for stability in all kinds of co-operation, supply chain management issues included, and that there may be a common belief that the public sector could adopt practices mostly seen in the private sector and mostly commercially motivated. In addition, the overwhelming majority of the women that answered the questionnaire also highly rated the provision of long service commitment, i.e. expressed their preference in a form of stability. This fact comes in line with Gill, Stockard, Johnson and Williams (1987) who stated that women are more likely to be affected by the environment and they seek more information and more time to decide.

The correlation matrix in Figure 1.2. revealed some interesting observations. All correlations are at an average point. The factor ‘’flexible and agile manufacturing’’ is negatively correlated (-0.578) with a CMI supplier being commercially strong and agile manufacturing is found to be negatively associated with a cost-leadership strategy. These two statements seem to introduce a view that this kind of strategy is considered to be very important and that it leads to a supplier/manufacturer being commercially strong while the agile manufacturing increases the risk of financial implications.

This view deviates from prior studies in the supplier selection area where delivery and quality are the most important criteria for strategy and decision-making (Degraeve at al., 2000; Hsu et al., 2006; Ho et al., 2010). Another consequence is the positive average correlation (0.467) of ‘’applying best practices’’ and ‘’develop and diffuse technology’’ since the second one appears to be the step for implementing best practices. The ‘’adoption of commercial buying practices through a restructuring of the relevant frame’’ is positively correlated (0.460) to ’flexible and agile manufacturing’’. This fact depicts the need to allow restructuring of the law and institutional frame for buying practices towards a more flexible and lead us to argue that the persons who filled

in the questionnaires may think that commercial buying practices are more efficient than the public ones in a CMI frame.

Descriptive statistics in Figure 1.3. demonstrated that ‘’Self-Regulation’’ and ‘’Social Pressure’’ were the most important and the less important characteristic, respectively, for a vendor selection team members in a CMI environment. “Self-regulation’’, a characteristic stemming from subject demands that associate with a decision maker’s internal factors, refers to the planning execution and evaluation of a decision on efficient, well-established criteria. This shows that people at key positions in a CMI environment, being responsible for important decisions, deviate from sociable and optimistic decisional tendencies and prefer a more mature and cautious procedure focused more on targets and long-term consequences. Another conclusion would be that, since maturity distinguishes the afore-mentioned procedure (for deciding), it is logical to assume people of a certain age (e.g. above 40) hold positions of power [competence is normally acquired with age (Lizarraga et al., 2009)].

Regarding ‘’Social Pressure’’, we may assume that it does not affect a decision, or the decisions seem to be taken without any external pressure or under the influence of emotions. CMI functions in a demanding frame and the scaling conclusions for ‘’Self-Regulation’’ and ‘’Social Pressure’’ exactly justify its nature. The executive members prefer experience and competence rather than external influences and socially acceptable decisions. According to Figure 1.3., there is a strong negative correlation (-0.640) for these 2 factors. In addition, the matrix shows a weak positive correlation for the factors ‘’Work Pressure’’ and ‘’Social Pressure’’ It can be explained if we take into account that both characteristics have aspects orientated to the compliance of rules, being socially likable by avoiding conflicts, and establish good relationship by favoring the employees/workers.

The regression analysis performed to the BFTs and the significance test of the main effects of the 5 BFTs was implemented at a 10% significance level, for the following hypothesis for each factor of the question:

$H_0 : a_i = 0$ for each i = 0,1,2…5 and α = 1st variable (Desired CMI characteristics) up to 8

$H_A : a_i \neq 0$ for at least one in order to decide whether each factor affects the response variables.

After the data entry, MINITAB produces outputs that reveal the following findings:

- The fit of a regression equation of the factor ‘’Conscientiousness’’ is statistically significant (P value = 0.005) and can interpret 60.6% of its data.
- The fit of a regression equation of the factor ‘’Agreeableness’’ is statistically significant (P value = 0.001) and can interpret 92.6% of its data.
- The fit of a regression equation of the factor ‘’Extraversion’’ is statistically significant (P value = 0.07) and can eventually interpret 84% of its data.
- The fit of a regression equation of the factor ‘’Openness’’ is statistically significant (P value=0.001) and can eventually interpret 72.2% of its data.
- The fit of a regression equation of the factor ‘’Neuroticism’’ is statistically significant (P value=0.001) and can eventually interpret 92.8% of its data.

The predictors/variables that affect the responses at a 10% significance level (p-value=0.1 equals to the observed level of significance) are the following:

- For Conscientiousness are (e) and (g), (i.e. the use of best practices and the mentality to develop and diffuse technology).
- For Agreeableness are (a), (c), (d), (f) and (h).
- For Extraversion are (c), (d), and (g).
- For Openness are (c), (d), (f), and (g).
- For Neuroticism (a), (c), (d), (e).

We also observed that predictors (c) and (d) are the predictors that appear the most, a fact that demonstrates the ongoing importance of the financial crisis in the CMI environment. In addition, a CMI environment is a demanding environment for a supplier as he/she is asked to operate in a ‘’two-mode’’ function and for that the necessary fiscal power should exist in order to be able, for example, to provide long service support for the civilian ‘mode’’ as well as for the military one.

Additionally, the above results show that:

- CMI desired characteristics affect different traits of personality and financially based issues with aspects of moral behavior ability affect mostly traits of their character, i.e. the BFTs.
- The potential high number and/or complexity of the materials may create different characteristics in each procurement attempt since different aspects of personalities are influenced, thus affecting the management's view of the problems inherent to them and requires experienced supply chain management.
- In descriptive statistics, the predictor (h) shows the highest value of the CI mean while in régression analysis it is the predictor with the minimum appearances as a statistically significant factor, i.e it affects the specific response with intensity.

The approach of this paper may be practicable in several real world applications of non-defensive areas as well. It provides objectivity as it combines well established statistical tools with a popular process that benefits from the experience of the persons that answered the questionnaire. It attempts to weld theory with practice under a common denominator, the requirement for a solid and cost-effective supplier selection tool. The overall usefulness of this model could be, besides its applicability in the defence public procurement area by its innovative character, the fact that it provided a guiding tool about which CMI desired characteristics severely influence personality traits. By that, supplier selection procedures may become more customized to the desired profile of the potential supplier through a process that will receive data from these characteristics and will try to enhance the traits that correspond more accurately to the nature of the supplying case at issue. FFM in a CMI environment has proven to be capable of providing an avenue of understanding which aspects of a personality are influenced, and how, by CMI characteristics. Moreover it gave us the opportunity to assess the desired traits a supplier selection team should have, which is an innovation, as most supplier selection paper turn their interest to the potential supplier and not to the team that selects him. Managerial implications of this model lie on its actual results. Managers can conclude that it would only be effective in real world-applications, which are affected by the vagueness of the human thought. Moreover, the model may reduce time for decision-making by simplifying and visualizing information for complex factors like personality factors.

Limitations and Future Research Directions

While this study has provided the frame for the identification of an effective supplier, by no means has it answered all questions concerning this issue and all its sources/references are available unrestricted. An additional limitation for this approach is that it was designed on a statically credible but small sample. Possible future inquiry would be to develop a fuzzy approach and import Multivariate Statistical Analysis Methods, such a Principal Components Analysis to further reduce the predictors under evaluation.

Annexes

Annex A: CMI questionnaire

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ANNEX A

CMI QUESTIONNAIRE

UNIVERSITY OF PIRAEUS

SCHOOL OF MARITIME AND INDUSTRIAL STUDIES

DEPARTMENT OF INDUSTRIAL MANAGEMENT AND TECHNOLOGY

This Questionnaire was designed by:	**CONTACT**	
Christodoulos Nikou in cooperation with the Supervisor.	Email: chrisnikou@gmail.com cnikou@unipi.gr Cell Phone: 00306972025152	
Approx. Completion Time: 10´		

TABLE WITH MAIN ELEMENTS					
FILLED-IN	FILLED-IN	FILLED-IN	**OPTIONAL** FILLED-IN	**AGE**	**Public or Private sector**
FULL NAME OF THE RESPONDENT (e.g. Christodoulos Nikou)	FIELD GRADE-MANAGEMENT LEVEL (e.g. Company	Directorate	Current working position	Up to 30 years old	

	Commander)				
				More than 30 years old	

1. This questionnaire was designed in order to help the authors to submit a paper for the 27th IPSERA Conference 2018.
2. The personal details of the respondents will remain confidential.
3. The responses do not reflect the official position of the Military Forces or any other Public Organization.
4. Good knowledge of the English language is required to filled-in the questionnaire.

SUPPLEMENTARY TABLE				
0-20% 1: Never	**20%-40% 2: Rarely**	**40%-60% 3:Sometimes**	**60%-80% 4:Often**	**80%-100% 5: Always**

Civilian Military Integration (CMI)

It is defined as the integration process of the defense technology and the industrial base of the private sector in one technological and industrial base. Common technologies, capital, labor force and infrastructure can be used to satisfy defense and commercial needs. In this framework, the questionnaire investigates the desirable characteristics of:

a. A supplier/manufacturer in order to provide items to an organization which is going to operate in a CMI environment.

b. A vendor selection team.

TABLE 1					
A. Evaluate all the desirable characteristics of a CMI supplier/manufacturer	1	2	3	4	5
a. Receptive in on site investigation					
b. Flexible and agile supplying/manufacturing					
c. Financially healthy					
d. Long service commitment					
e. Application of “best practices” of his sector					
f. Bridging of military standards with commercial practices					
g. Develop and diffuse technology					
h. Adoption of commercial buying practices through the reform of legal and statutory frame (different from e.)					

Five Factor Model (FFM)

It is a hierarchical model of personality analysis using five widely-described characteristics. The following table presents a brief analysis of these characteristics:

TABLE 2

Big Five Trait	Characteristics	General Description
Conscientiousness	Being dependable, carefully, thorough responsible, organized, planful, hardworking, achievement oriented and persevering	Inclination to achievement orientation (hardworking and persistent), dependability (responsible and careful), and orderliness (planful and organized)
Extraversion	Being sociable, gregarious, assertive, active, powerful and talkative	Propensity for social orientation (outgoing and gregarious), to be surgent (dominant and ambitious) and active (adventuresome and assertive)
Agreeableness	Being courteous, flexible, trusting, good-natured, cooperative, forgiving, soft hearted and tolerant	Propensity to be cooperative (trusting of others and caring) as well as likeable (good natured, cheerful and gentle)
Openess	Being imaginative, cultured, curious, original, broad-minded, intelligent and artistically sensitive	Disposition to intellectance (philosophical and intellectual) and unconventionality (imaginative, autonomous and nonconforming).
Neuroticism	Being anxious, depressed, angry, embarrassed, emotional, worried and	Tendency to render a lack of positive psychological adjustment

	unsecured	and emotional stability
Source: Wifling and al.,2011		

The following table tries to quantify the five personality characteristics on the basis of the desirable characteristics of a CMI supplier (**a to h in Table 1**) and the Table 2. Based on the above description, fill-in Table 3 using a scale of 1 to 5 (**decimal numbers acceptable**).

TABLE 3	Number in this field indicates the weighting on the profile of the CMI supplier	**a to h are the elements of Table 1:** Put number from 1 to 5 in **all** fields and then put **one number** from 1 to 5 in Big Five trait on the basis of the numbers in the specific elements**.**							
Big Five trait		a.	b.	c.	d.	e.	f.	g.	h.
Conscientiousness									
Extraversion									
Agreeableness									
Openess									
Neuroticism									

In the table in the next page, we want your opinion regarding the desirable characteristics of the members of the vendor selection team in a CMI environment.

4. : Desirable characteristics of the vendor selection team in a CMI environment (How much important is for a member of the team to has this characteristic)	1	2	3	4	5
Time/Money Pressure – TMP (Explained as follows)					
I. Evaluate the available time in which to make my decision					
II. Organize the actions depending on the time.					
III. Act quickly and precisely					
IV. Make sure the established times are respected.					
V. Determine whether costs match the money available.					
VI. Imagine economical options.					
VII. Compare results with time employed.					
VIII. Compare results with money spent					
5. : Desirable characteristics of the vendor selection team in a CMI environment (How much important is for a member of the team to has this characteristic)	1	2	3	4	5
Information and Goals – IG (Explained as follows)					
IX. Study the degree of difficulty of the decision.					
X. Organize the action sequence if the decision is complex.					
XI. Gather as much information as possible about the decision.					
XII. Discover the key information about the decision.					
XIII. Realize which information is lacking.					
XIV. Define the desired goals.					
XV. Analyze whether the goals interfere with each other.					
XVI. Choose the appropriate actions for the decision					
6. : Desirable characteristics of the vendor selection team in a CMI environment (How much important is for a member of the team to has this characteristic)	1	2	3	4	5
Self-Regulation – SR (Explained as follows)					
XVII. Know where I'd like to get to.					
XVIII. Trust my own personal experience					
XIX. Trust my personal capacity to overcome the difficulties					
XX. Plan the actions to be performed					
XXI. Use the strategies that seem the most efficient					
XXII. Monitor all the phases of the decision process					
XXIII. Appraise the achievements gained by the decision					
XXIV. Identify the errors committed in the choice.					
7. : Desirable characteristics of the vendor selection team in a CMI environment (How much important is for a member of the team to has this characteristic)	1	2	3	4	5
Cognition - COG (Explained as follows)					
XXV. Process the information about the issue to be decided					
XXVI. Reflect on the need to make the decision					
XVII. Identify the factors that affect the decision					
XVIII. Recall previously employed decision strategies					
XIX. Solve the problems that arise					
XXX. Relate the highest number of aspects of the decision.					
8 : Desirable characteristics of the vendor selection team in a CMI environment (How much important is for a member of the team to has this characteristic)	1	2	3	4	5
Social Pressure – SCP (Explained as follows)					
XXI. Avoid any conflict with others					
XXII. Make decisions without external pressure					
XIII. Adapt to the pace required by the environment					
XIV. Listen to other people's opinions about the decision					
XXV. Determine whether the consequences of the decision are socially acceptable					
XVI. Determine whether the decision respects social rules					
XVII. Examine whether socio/political ideas affect the decision.					
9. : Desirable characteristics of the vendor selection team in a CMI environment (How much important is for a member of the team to has this characteristic)	1	2	3	4	5
Work Pressure – WKP (Explained as follows)					
XVIII. Discover the relation between work rules and personal interests					
XIX. Follow work rules					
XL. Comply with the demands of the law					
XLI. Take the goals of the business into account					
XLII. Favour the workers					

THANK YOU VERY MUCH FOR YOUR TIME

The Achilles' Heel: Can compliance become the performance lever that developing country public procurement systems need?

Godfrey Mugurusi[§]
Department of Economics and Technology Management in Gjøvik (IØT-G)
Norwegian University of Science and Technology, Norway

Doreen Kyazze Mulema
Public Procurement and Disposal of Public Assets (PPDA), Uganda

Alex Nduhura
Uganda Management Institute, Uganda

Abstract
Developing country public procurement systems depend significantly on the inherent legal frameworks to assure regulatory compliance. Public procurement compliance mechanisms have a significant effect on procurement performance of most public organizations, yet the practice of assuring public procurement compliance is not the most efficient and effective. Thus, does enforcing compliance in public procurement drive procurement performance or is this a not-worthy activity in developing public procurement systems?
To answer this question, we carried out a mini-survey within the two (2) biggest spend public organizations in Uganda, i.e. the Uganda National Roads Authority and Kampala Capital City Authority. In particular, four (4) susceptible non-compliance areas in the procurement process are studied: - procurement planning, contract management and record keeping and reporting. In addition, the study draws on documentary data from the Public Procurement and Disposal of Public Assets Authority (PPDA) as the regulatory compliance enforcer of the public procurement system in Uganda.
The findings suggest that not all compliance checks conducted into the studied processes, activities, documents etc of public organizations ensure better procurement performance among these organizations. In fact, compliance to procurement planning and contract management regulatory demands had strong implications for procurement performance as compared to record keeping and reporting in the procurement process. These findings infer that although process wide public procurement compliance does not necessarily safeguard better performance, targeted activities in the procurement process can guarantee efficient and effective procurement performance. We conclude that procurement compliance could be the "other" unfamiliar procurement performance that most public procurement systems need for effective service delivery.

Key words: *Public Procurement; Compliance; Procurement performance; Developing Countries*

Introduction
Compliance has traditionally been understood as conformity or obedience to regulations and legislation (Snell, 2004: Gelderman, Ghijsen, & Brugman, 2006: Eyaa & Oluka, 2011), yet like Brandon-Jones (2009) observes: "compliance is notoriously hard to force – individuals invariably find a way round things they dislike": hence an "Achilles heel" for most procurement systems. From a public procurement performance perspective, compliance is very critical as public procurement processes depend on adherence to proper processes and procedures. Surprisingly

[§] Corresponding Author: godfrey.mugurusi@ntnu.no : (47) 91271022

research has paid little attention to the issue of public procurement compliance, despite some academics (e.g. Arrowsmith & Anderson, 2011: Eyaa and Oluka, 2011) suggesting that performance of public procurement organizations significantly depends on how best they comply to procurement controls in place such as regulatory adherence, process requirements and contract audits in line with the legal frameworks in which they function. This therefore begs the question: *To what extent does procurement compliance contribute better procurement performance? Does enforcing compliance in public procurement compel better procurement performance, or is this worthy activity in developing country public procurement systems?* In answering these questions, we hope to contribute by providing an in-depth assessment of the precise effect of public procurement compliance has on performance of public organizations, which for a longtime has been associated with how efficient these organizations are in delivering public services (Agaba and Shipman, 2007)

This paper is organized as follows. We begin with the background, anchoring the problem as one faced by most developing countries. Next, we review the literature about compliance and procurement performance, with particular emphasis on: planning, contract management and record keeping and reporting. Thereafter we present the methods used for data collection and the results. Finally, we discuss and conclude on the results. We briefly present some managerial implications of this paper at the end.

Background – the problem of interest

For most developing countries, the strengthening of public procurement systems has been one of the key reforms prioritized by these governments. In Uganda for example, the Public Procurement and Disposal of Public Assets Act (a piece of legislation which governs the entire public procurement system) specifically emphasizes compliance reporting as a legal obligation for all organizations that procure public goods. The continuous increase in corruption cases and embezzlement of public funds in public agencies is attributed to non-adherence to procurement set laws, rules, guidelines and standards. This according to Mahmood (2010) and Agaba and Shipman, (2007) are typical signs of non-compliance and manipulation of the procurement procedures: the most affected areas in a typical public procurement process are at planning, management and administration of contracts, and record keeping. In Uganda specifically, the reviewed PPDA audit reports from the period 2010 to 2015 show that the high performing public organizations score highly in overall reporting, effective record keeping, procurement planning and contracts management. However, the PPDA compliance report (2015), the IGG Report (2014) and OAG Report (2013) suggest that these high performing organizations conversely scored poorly in procurement performance owing partly to non-compliance to procurement regulations. Essentially suggesting that non-compliance in procurement has a less significant effect on organizational performance, but from an institutional theory perspective (Rowan,1982: Scott 2004), functional performance cannot be detached from organizational performance.

Theoretically we draw on the institutional theory (Scott 2004: Zsidisin, Melnyk, & Ragatz, 2005: Meehan, Ludbrook, & Mason, 2016) partly because the institutional theory highlights the tensions between compliance and achieving efficiency and effectiveness, but mainly we posit that institutional demands for convergent business practices undermine the capacity for specific institutions to be more efficient which in turn affects functional performance.

Compliance in Public procurement and Procurement performance

Compliance is the degree to which an agent adheres to principal's directives, policies and procedures. The Oxford Dictionary (2015) defines "compliance" as the state or fact of according with or meeting rules or standards. Payan and McFarland (2005) referred to compliance as to a

target acting in accordance with an influence attempt from the source. From a public procurement perspective, Gelderman, Ghijsen and Brugman (2006) look at compliance with the procurement rules as a dichotomous variable that is, either one complies or one does not. Abebe (2012) measured the level of compliance by the Best Efficiency Accountability and Transparency Model, which indicates three highly interrelated principles thus, efficiency, accountability and transparency as essential ingredients in procurement compliance.
It is no coincidence therefore that effectiveness and efficiency are central concepts that link compliance and procurement performance. Van Weele (2006) revealed that procurement performance is considered the result of two elements: purchasing effectiveness and purchasing efficiency. Specifically, public organizations know that effectiveness of the use of public funds, including development assistance requires the existence of an adequate national procurement system that meets international standards and that operates not only to deliver public goods/services but also ensures value for money (Asare & Prempeh, 2016). This means that purchasing performance is not an end in itself but a means to effective and efficient control and monitoring of the purchasing function (Lardenoije, Van Raaij, and Van Weele, 2005).

Broadly, procurement looks at obtaining from external sources all goods and services which are necessary for running, maintaining and managing the organization's primary and support activities at the most favorable conditions (Van Weele, 2006). Within this process, Rendon (2008) summarizes the key procurement sub-processes as those to include: procurement planning, solicitation planning, solicitation, source selection, contract administration and contract closeout. Among these, and as earlier mentioned, the most susceptible to non-compliance include: record keeping, procurement planning, procurement reporting and contract management.

Planning is a process that consists of many steps and the bottom line is that planning is not concerned with future decisions but rather with the future impact of decisions made today (Thai, 2004: Robbins, 2001). From a procurement perspective, procurement planning is the primary function that sets the stage for subsequent procurement activities; it fuels and then ignites the engine of the procurement process (Basheka, 2008). It is very critical since non-compliance in procurement planning has wide implications for both functional and organizational governance. Thai (2004) notes that procurement planning enables the identification of major investment expenditures, which in turn facilitates budgetary decision-making.

Like planning, effective contract administration cannot be underestimated (Nullmeier, Wynstra, & van Raaij, 2016). Known also as contract management, this is a continuous process, starting with analysis and evaluation of the customer's inquiry, until contract closure, upon fulfillment of all contractual obligations (Brown & Potoski, 2003). The criticality of this step is how the contractual relationship is documented in the contract, not just the mechanics of administering the contract (Mendoza, 2007). Agreements, models and processes form a useful starting point for assessing whether the contract is underperforming, but communication, trust, flexibility and diplomacy are the key means through which it can be brought back on course.

Finally, procurement records and reporting working in tandem with procurement planning and contract management sub-processes. According to an ARMA International report (2005), organizational records facilitate how employees perform daily transactions. A record is a piece of information created by or received by an organization or business that gives evidence of a business decision or transaction and should be prescribed (Stewart, 2002). As such, the integrity of those records, facilities business continuity and compliance with legislative and regulatory requirements as well as manage risks. The loss of control of records has consequences for not

just employees and but the public since inadequate information systems affect the delivery of public goods.
The same can be said about procurement reporting. Typically, procurement reporting is a mechanism for information exchange between management, purchasers, and internal and external teams about the current procurement situation in the organization (Hunja, 2003). In this respect, suitable key procurement performance indicators as well as appropriate information and recommendations are compiled in a report for each recipient group either monthly/quarterly or spontaneously (Gunasekaran, Patel, & Tirtiroglu, 2001). According to the PPDA Act 2003, the PPDA checks that the method is appropriate to the amount and enters all details into a database. At central government level, the average delay in reporting is 8 months and some organizations fail to report altogether. False reporting maybe detected by field audit. There is a major improvement over the past years but still inadequate to deter concealment of noncompliance or splitting of contracts to put them below the respective thresholds.

We therefore summarily hypothesize that: *compliance to procurement planning positively contributes to better procurement performance (H1), just like compliance to contract management requirements positively contributes to better procurement performance (H2). Because of the link among the two key process activities (planning and contract management), we expect that the compliance to the record keeping and compliance to the procurement reporting requirements positively affects procurement performance (H3 and H4 respectively).*

The correlational research design – a mini survey
According to Sekaran (2004) correlational research is predominately a quantitative method of research that seeks to determine if there is a relationship between the two variables. It typically seeks to identify predictive relationships by using correlations or more sophisticated statistical techniques (Thompson, Diamond, McWilliam, Snyder, & Snyder, 2005). In this case, the two variables understudy is procurement compliance and procurement performance.
The interest of the study are the selected two highest spend and top ranked public sector organizations by performance in Uganda according to the PPDA compliance report (2015). The two are Uganda National Roads Authority (UNRA) and Kampala Capital City Authority (KCCA). Confirmatory documentary data is further collected from PPDA, the procurement regulatory body in Uganda.
The Uganda National Road Authority, UNRA is a public agency in Uganda with 956 employees, and whose mandate is to develop and maintain the national roads network, advise government on general roads policy and contribute to addressing transport concerns, among others. The UNRA budget for construction, maintenance and management of the country's national road network for the financial year 2016/2017 was US$494m (1.8trilion Uganda Shillings) (Uganda's 2016/2017 budget report). KCCA on the other hand, Kampala Capital City Authority (KCCA) is the government agency responsible for governance of the Capital City Kampala on behalf of the central government. As of 2016, KCCA had 1300 employees. The Authority, whose budget for the financial year 2016/2017 was US$154 million (561 Billion Uganda Shillings) (Uganda's 2016/2017 budget report), is mandated to provide public services following the public procurement guidelines.
The procurement activities of the above 2 organizations are governed under the PPDA Act of 2003 and amended in 2014: the same law that establishes the Public Procurement and Disposal of Public Assets Authority – the PPDA. The PPDA is the procurement regulatory body in Uganda, whose many roles is to among the many roles is to monitor compliance of procurement and disposal organizations that are publically funded.

The targeted study population was employees involved in the procurement function in the 2 organizations, who included the procurement department staff, administrative and technical staff, and accounting and finance staff who in total are involved in a typical procurement process (Table I). The survey also targeted key decision makers from PPDAs compliance department for confirmatory data.

Using both simple random and purposive sampling techniques, the sample for the study was 104 respondents. We draw on predominately on a mini-survey between the two organizations (UNRA and KCCA) and supplement this with selected interviews and documentary data from PPDA.

The mini-survey containing a set of questions on defined variables under study was administrated on a self-administered basis. The target of 96 respondents, only 65 respondents returned the questionnaires representing 68% response rate. This is an acceptable response rate for social science research according to Nulty (2008). In order to overcome the challenges of questionnaire surveys, we also considered secondary documentary data to (dis)confirm the quantitative data. Accordingly to Trautrims, Grant, Cunliffe & Wong (2012), data triangulation is important not just to give more insights into the phenomenon, but also ensures that inconsistencies in data sets are more easily identified and aligned.

Table I: Summary of Sample size and Sampling Techniques

Category	**UNRA**	**KCCA**	**Targeted population**	**Sample Size**	**Sampling Techniques**
Procurement department	11	14	25	24	Simple random**
Accounting & finance dept.	14	10	24	23	
Administrators/Technical staff	27	28	55	49	
Total			***104***	***96***	
PPDA Compliance Department			10	8	Purposive
Total			***114***	***104***	

** 5% sampling error, and 95% confidence level

The Results – Quantitative Data

The questionnaire asked respondents to rank their responses to a series of statements in the mini-survey along a 5– point Likert scale ranging from 5 – strongly agree; 4 – agree; 3 – neutral, 2-disagree; and 1 – strongly disagree. The statements asked around the four (4) susceptible non-compliance areas in the procurement process are studied, namely procurement planning, contract management and record keeping and reporting in relation to procurement performance of public organization. The descriptive results have not been included, but hereafter the results of the correlation analysis and are regression analysis descriptively presented.

Table II: Correlation Analysis: Compliance to procurement planning requirements and procurement performance

We assessed the procurement planning practices of the sampled organizations in relation to their overall procurement performance (H1). The coefficient result in Table II below suggests that the correlation between compliance to procurement planning requirements and procurement performance is a statistically significant positive correlation (Pearson correlation r=0.642, p-value<0.01). This therefore implies that the sampled public organizations procurement planning practices significantly influence their overall procurement performance.

		Procurement Planning	**Procurement Performance**
Procurement Planning	Pearson Correlation	1	.642**
	Sig. (2-tailed)		.000

	N	62	62
Procurement Performance	Pearson Correlation	.642**	1
	Sig. (2-tailed)	.000	
	N	62	62

**. Correlation is significant at the 0.01 level (2-tailed).

The regression analysis model between compliance to procurement planning and performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.642[a]	.412	.401	.56536	.412	39.899	1	57	.000

a. Predictors: (Constant), Procurement Planning

The regression analysis model above confirms the findings in Table II on the effect compliance to procurement planning has on procurement performance but yet that effect on procurement performance can only be explained by compliance to procurement planning requirements for up to 41 % (R square of 0.412).

Table III: Correlation Analysis: compliance to contract management requirements and procurement performance

We assessed the contract management practices of the sampled organizations in relation to their overall procurement performance (H2). The coefficient result in Table III below suggests that the correlation between compliance to contract management requirements and procurement performance is a statistically significant positive correlation (Pearson correlation r=0.629, p-value<0.01). This therefore implies that the sampled public organizations contract management contract significantly influence their overall procurement performance.

		Contract management	**Procurement Performance**
Contract management	Pearson Correlation	1	.629**
	Sig. (2-tailed)		.000
	N	59	59
Procurement Performance	Pearson Correlation	.629**	1
	Sig. (2-tailed)	.000	
	N	59	59

**. Correlation is significant at the 0.01 level (2-tailed).

The regression analysis model between compliance to contract management requirements and procurement performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.629[a]	.495	.385	.57327	.395	37.243	1	57	.000

a. Predictors: (Constant), Contract management

The regression analysis model above confirms the effect compliance to contract management requirements has on procurement performance but that effect on procurement performance can

only be explained by compliance to procurement reporting requirements for up to 50% (R square of .495).

Table IV: Correlation Analysis: compliance to record keeping requirements and procurement performance

We assessed the record keeping behavior of the sampled organizations in relation to their overall procurement performance (H3). The coefficient result in Table IV below suggests that the correlation between record keeping requirements and procurement performance is not statistically significant (p-value>0.01). This therefore implies that the sampled public organizations record keeping behavior does not significantly influence their overall procurement performance.

		Record Keeping	**Procurement Performance**
Record Keeping	Pearson Correlation	1	.207**
	Sig. (2-tailed)		.115
	N	62	62
Procurement Performance	Pearson Correlation	.207**	1
	Sig. (2-tailed)	.115	
	N	62	62

**. Correlation is significant at the 0.01 level (2-tailed).

Table V: Correlation Analysis: compliance to procurement reporting requirements and procurement performance

We assessed the procurement reporting behavior of the sampled organizations in relation to their overall procurement performance (H4). The coefficient result in Table V below suggests that the correlation between compliance to procurement reporting requirements and procurement performance is a statistically moderate correlation (Pearson correlation r=0.473, p-value<0.01). This therefore implies that the sampled public organizations procurement reporting behavior has little influence over their overall procurement performance.

		Procurement Reporting	Procurement Performance
Procurement Reporting	Pearson Correlation	1	.473**
	Sig. (2-tailed)		.000
	N	62	62
Procurement Performance	Pearson Correlation	.473**	1
	Sig. (2-tailed)	.000	
	N	62	62

**. Correlation is significant at the 0.01 level (2-tailed).

The regression analysis model between compliance to procurement reporting and procurement performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.473[a]	.224	.210	.64948	.224	16.422	1	57	.000

a. Predictors: (Constant), Reporting

The regression analysis model above confirms low effect compliance to procurement reporting has on procurement performance but yet that effect on procurement performance can only be explained by compliance to procurement reporting requirements for up to 22% (R square of 0.224).

Results – the Secondary sources

This section presents results from the review of several documents from the PPDA predominantly guided by the research questions of the study.

Table VI: Document Review Analysis

No.	Document	Compliance to:			
		Procurement Planning Requirements and Procurement Performance	**Contract Management Requirements and Procurement Performance**	**Procurement Reporting Requirements and Procurement Performance**	**Record Keeping Requirements and Procurement Performance**
1.	KCCA Audit and performance Report FY 2015/16	There were delays in confirmation of availability of funds for two procurements. 18% of the total contracts were not implemented according to market price which implies a gap in estimation at the time of procurement planning	65% of the procurements sampled were conducted in accordance with the planned timelines. The Entity completed 75% of the sampled procurements within the contractual completion time. 85% were awarded within the cost estimate in the procurement plan	The procurement plan and 100% of the monthly reports were submitted to the Authority.	The Procurement and Disposal Unit maintained records pertaining to pre-contract; however, contracts pertaining to post contract management were not always availed to the PDU to maintain on the respective procurement action file.
2.	UNRA Audit Report FY 2015/16	The Entity conducted procurements outside the Procurement Plan There were variances in estimates between the approved estimates in the Procurement Plan and the estimates indicated on the requisition. There were variances between the estimated and final contract prices Delays at initiation that lead to delays in the procurement process and delayed service delivery The Entity implemented 51.4% of its procurement budget, which implies that the Entity did not fully implement its procurement plan.	The audit revealed unjustified delays at the contracting and contract management stage Laxity by the contract managers to invoke the penalties on delays provided in the Special Conditions of Contract. 8% of the total contracts were not implemented according to market price which implies a gap in estimation at the time of procurement planning	The procurement plan and 100% of the monthly reports were submitted to the Authority Failure to report procurement data into the performance system makes it difficult for the entity to assess their individual performance and for the Authority to identify and recommend targeted actions towards the key performance areas under PPMS that are weak and require additional support. .	Lack of records for some procurements evidencing payment to the PDU from the Finance department for maintaining on file.

3.	PPDA Annual progress report. FY 2015/16	6% of the PDEs conducted procurements outside the procurement plan 25% of the Organizations did not follow the schedules set out in their procurement plans which leads to late initiation of procurements or emergency/direct procurements There was increase in unimplemented planning recommendations mainly related to poor estimation of Procurement requirements. Poor absorption of procurement budgets due to poor level of planning by Organizations as well as late initiation of procurements	Delays in completion of contracts lead to delays in service delivery. The Authority observed that delays in evaluation of progress reports and payment result in delayed contractor performance as providers end up with insufficient funds to implement projects. The Authority also noted that Organizations are not implementing recommendations related to contract award and implementation, which include poor contract monitoring, appointment of contract managers, delayed payment of providers and preparation of the contract management reports.	76% of organizations submitted procurement reports.90% submitted procurement plans The non-compliance to submission of procurement plans is partly as a result of some new PDEs in the that did not have their procurement structures fully filled. 52% of the PDEs did not submit their reports on time leading to omnibus submissions 15% of the PDEs submitted incomplete procurement plans Submission of procurement plans and reports should improve with the roll out of the Government Procurement Portal as it creates a platform for PDEs to post their Procurement plans online.	9% of the unimplemented audit recommendations were related to record keeping especially contract management records and payment records.

Source: *Secondary data*

Discussion and Conclusion

The results reveal a rather interesting dimension which forms our discussion going forward. That, not all procurement process activities are integral to procurement performance. However, some of these activities enable of the process deliver efficient outcomes. We know from a Harland, Telgen, & Callender, (2013) and Brandmeier & Rupp (2010) that by leveraging key process activities, procurement can achieve its performance related goals, which in the public setting include: value for money, managing cost and risk, meeting socioeconomic targets etc.

We purposively studied and tested 4 key process levers that included planning, contracts management, record keeping and reporting, which according to Thai (2001) and Amemba, Nyaboke, Osoro, & Mburu (2013) should are integral process activities that have an impact on value for money.

Table VII: Hypothesis testing summary

Hypothesis		**Result**
H1	Procurement planning → (+) procurement performance	Supported
H2	Contract management →(+) procurement performance	Supported
H3	Record keeping→ (+) procurement performance	Not supported
H4	Procurement reporting→ (+) procurement performance	Not supported

As the results suggest in Table VII, public entity's compliance to record keeping and reporting requirements has little effect on the performance of the procuring organizations. This however should not suggest that record keeping and reporting are any less significantly important compared to other sub-processes included in the survey. The lack of action procurement action files has significant impact on how a procurement entity is rated. Incomplete records affects the audit trail making it difficult for oversight institutions for example the PPDA to assess the Entity's performance. The study revealed that lack of reporting on procurement information affects the entity's ability to monitor their individual performance. Without reports, the Entity and regulatory body cannot identify and recommend targeted actions towards improving the key performance areas that are weak and require additional support. Poor record keeping affects the ability by the user departments of the PDUs to carry out effective contract monitoring (Amemba et al 2013: Manavazhi & Adhikari, 2002.).

The results confirm that both planning and contract management are central aspects in public procurement performance. Basheka (2008) concurs that procurement planning is the primary function that sets the stage for subsequent procurement activities According to Bonser & Wu (2001) planning is an essential aspect of public procurement performance allows procurement organizations prioritize resources for effective service delivery. Basheka (2008) suggests that through planning, the procurement function is able to manage time effectively by estimate the time required to complete the procurement process and award contract for each requirement. This can be a basis for combining or dividing procurement requirements into different contract packages to allow effective contract administration (Brown & Potoski, 2003).

In addition, the PPDA Act (2003) provides that prior to the commencement of a procurement process an Accounting Officer should undertake an assessment of the market price of the supplies, services or of the unit costs of the works in respect of which the procurement is to be made. Such controls, including one that authorizes an Accounting Officer not sign a contract,

where the price quoted by the bidder is higher than the market price established by the Accounting Officer, suggest the important this sub process has on the entire procurement cycle. Therefore, compliance to such provisions tends to lead to improved procurement performance in terms of procurements conducted within the planned budgets and timelines and contracts implemented under clearly approved terms.

In addition, the role of effective contracts management cannot be underestimated. The correlation between compliance to contract management requirements and procurement performance was positive. The regression analysis indicates procurement performance is explained by compliance to procurement planning up to 50%. According to Mendoza (2007), the overriding rather fundamental aim of contract administration is to ensure the delivery of cost effective and reliable service at an agreed price and standard. The study revealed that the major challenge in the area of contract management is unjustified delays at the contracting and contract management stage that in the long run leads to delays in service delivery. The findings further reveal that the poor performance of appointed contract managers leads to poor quality of the conducted procurements.

So, as we demonstrate using a mini survey carried out in Uganda, compliance to key procurement sub-processes can provide for better procurement performance in most developing country procurement systems. But to what extent can procurement compliance be considered as "another lever" for procurement performance in a public sector performance?

Bedi (2017) suggested that levers are "a set of actions that enable procurement to achieve its goals". Using supply related concepts, Bedi (2017) further suggested that procurement levers are mainly 4: price-based levers, total cost levers, demand management levers and supply base levers. In public sector procurement setting, these levers are embedded activities in the procurement process (Thai, 2001: Hunja, 2003).

We argued earlier and as shown by the results, that compliance to procurement process requirements can be leveraged for better performance. This evidently suggested that compliance is public procurement performance lever. Tukamuhabwa (2012) and Gesuka & Namusonge (2013) show that the impact of non-compliance has significant impact on the entire procurement system in terms of poor service delivery to tax payers and no value for money in public projects.

The evidence presented in the paper, although not thoroughly conclusive, it appears to suggest that procurement compliance is a fundamental lever to ensure the efficient and effective execution of the procurement process and as such better procurement performance in the long-term.

Implications for managerial practice

Despite its methodical and structural challenges, this paper highlights a number of implications which public procurement organizations could consider going forward. Evidence has shown limited interest in procurement compliance, which is currently at the periphery of most developing world public procurement systems. Here, we demonstrate that compliance is key to better performance: in particular compliance within planning and contracts management.

As part of the efforts to plan for institutional procurement needs, most countries have resorted to using their annual procurement plans as a possible way of managing few resources. Yet these are not effectively monitored to ensure compliance (Mahmood, 2010). The reforms towards

electronic information systems should reduce the amount of manual records required and improve on the monitoring of the procurements. Moreover, such electronic management information systems would help public organizations to improve contract management, the reporting and monitoring of procurement activities.

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STUDENTS' PERCEPTIONS OF THE SUPPLY CHAIN STUDENT ASSOCIATION AT THE UNIVERSITY OF KWA-ZULU-NATAL

Micheline Naude and Nomalizo Dyili

University of KwaZulu-Natal, South Africa

Summary

This paper uses exploratory and descriptive research approaches to provide insight into an initiative, introduced by two third year supply chain management students at the University of KwaZulu-Natal to enhance their supply chain learning.

South Africa experiences various skills shortages. Suitably skilled staff in Supply Chain Management is recognised as a scarce skill in the National Scarce Skills List. Even though the number of students enrolling for supply chain management modules is increasing, more is needed to close this skills gap.

The purpose of this paper is to provide insight into students' perceptions of the Supply Chain Student Association at UKZN. Data was gathered through a structured questionnaire administered to students who are members of the Supply Chain Student Association.

The findings reveal that the main factors contributing to the success of the association, include seminars, the creation of interaction and site visits. The main factors limiting the success and effectiveness of the association, include lack of communication and financing.

Key Words: Supply Chain Student Association; Supply Chain Management; supply chain learning initiatives.

Submission category: Educational Paper

Introduction

Supply chains are growing in significance as businesses realise that supply chains are important change agents of the future. While both Dell and Wall-Mart have become successful because of their business model the increasing effective use of the supply chain has been the enabler to allow for this (Fawcett, Ellram and Ogden, 2014). Major trends in Supply Chain Management include: increased global competition, more demanding customers, changing customer demands, high-quality innovative products, and globalisation (Bozarth and Handfield, 2013; Fawcett et al, 2014; Sanders, 2012). This has increased the complexity of supply chains which, in turn, has increased the need for skilled staff in the field of Supply Chain Management.

In the South African publication *National Scarce Skills List: Top 100 Occupations in Demand*, suitably skilled staff in Supply Chain Management at operational and management level are listed (Government Gazette 380: 2014). The increasing demand and lagging supply is considered to be a challenge for stakeholders in the business environment. The identification of current and future skills gaps are necessary as this informs tertiary and training institutions as to what education and training should be provided to meet the needs of society and the economy.

Gattorna (2006) notes "*It is people who drive the supply chain, both inside and outside your business, not hard assets or technology. You can't do **anything** without the right people*". Mangan, Lalwani, Butcher and Javadpour (2012) define these "right people" as those with the right skills and knowledge to ensure that supply chain strategies will be carried out effectively and efficiently. Thus suitably educated, skilled and trained supply chain practitioners are required for businesses to succeed with functional knowledge being a base requirement for these supply chain managers of the future.

In 2014, two third year supply chain students at the University of KwaZulu-Natal, Westville Campus, noted that students at other higher learning institutions in South Africa had created students associations. These were based on the premise of their being a gap between a students' academic knowledge and the requisite industry knowledge. They identified a similar gap in their own institution and wanted to explore the opportunities. As a result the Supply Chain Student Association (SCSA) was founded.

The mission of the SCSA is to garner knowledge through research into industry-specific issues to improve students' practical knowledge of supply chain management. In order to achieve this, the SCSA holds two workshops per semester, two seminars per semester, monthly general meetings and organises two factory visits per year.

Within this context, the research question of this study is:

> *Does the Supply Chain Student Association, at UKZN, benefit students and what are the benefits and limiting factors of this Association?*

Against this background, the aim of this study is to provide an overview of the association, determine the benefits and limiting factors of this association, and whether it has been successful in attracting students.

This paper consists of a brief background of the UKZN, insight into Supply Chain Management modules offered at second, third and fourth year level, the research methods used for this research, the findings and concludes with recommendations for further study.

Background of the University of KwaZulu-Natal

The University of KwaZulu-Natal was formed on 1 January 2004 as a result of the merger between the University of Durban-Westville and the University of Natal. The University of KwaZulu-Natal has five campuses. Three of the campuses are based in Durban and these are: Westville Campus (which houses the office of the Vice-Chancellor, the offices of Executive members and University-wide administrative divisions); Howard College; and the Medical School. The other two campuses are Edgewood Campus (based in Pinetown) and Pietermaritzburg Campus (based in Pietermaritzburg). Supply Chain modules are offered at Westville and Pietermaritzburg Campuses only.

The study that forms the basis of this document took place in the School of Management, Information Technology and Governance at Westville campus during the 2016 academic year.

Supply Chain Management Majors at UKZN

One of the primary goals of the Higher Education Qualifications Framework (HEQF) in South Africa is to "facilitate the education of graduates who will contribute to the social, cultural and economic development of the country and participate successfully in the global economy and knowledge society" (Republic of South Africa, 2007). In this context, Supply Chain Management education needs to develop professionals that can apply their skills in industry. Therefore, industry needs have to be determined as starting point to develop curriculums.

UKZN offers four supply chain major modules at third year level as part of a Bachelor of Commerce Degree, for students who intend to major in Supply Chain Management. These major modules are: Purchasing Management; Operations Management; Logistics Management; and Special Topics in Supply Chain Management. In order to register for these modules, the prerequisite module is the Introduction to Operations Management, offered at second year level.

UKZN also offers a fourth year degree, namely the Bachelor of Commerce Honours Degree, a research Masters Degree and a PHD in Supply Chain management. Table 1, provides the students numbers at the two campuses at UKZN registered for supply chain management at Undergraduate and Honours level between 2014 and 2017.

Table 1 refers - of note, in 2015, is the decrease in the numbers for the third year classes at the Westville Campus. This had an effect on the honours class intake in 2016. Besides that, the student numbers between 2015, 2016 and 2017 have shown an overall increase.

Table 1: Student numbers Pietermaritzburg and Westwille Campuses

	PIETERMARTIZBURG				WESTVILLE			
	2014	**2015**	**2016**	**2017**	**2014**	**2015**	**2016**	**2017**
SCMA2OP*	426	396	259	156	596	763	422	208
SCMA2OM				81				273
SCMA301	142	129	149	127	445	321	384	372
SCMA305	123	114	136	103	420	294	369	361
SCMA306	115	108	115	97	401	280	370	338
SCMA311	129	109	116	111	379	258	324	333
SCMA7A0	14	14	12	14	114	113	68	101
SCMA7B0	14	14	10	14	109	112	70	103
SCMA7C0	14	14	11	15	108	115	58	102
SCMA70M**					112	85	32	55
Research Project	12	12	11		101	104	58	102

* This module will no longer be offered in 2018.

**This module is currently only offered on the Westville campus, as there is no capacity to offer it on the PMB campus.

Research Methods

A qualitative methodological approach was followed. This study is exploratory and data was collected through administering a questionnaire to the 106 members of the SCSA The questionnaire consisted of open-ended questions. The purpose of the questionnaire was to identify the benefits and limiting factors of this Association and whether it has been successful in attracting students to its ranks. Prior to empirical data collection, a letter of introduction was sent to the students asking them to participate in this study. Respondents were made aware of the purpose of the research and assured of their anonymity with participation in the study being voluntary. The response rate was 35.85% (38 out of 106 questionnaires). NVivo was used to analyse the qualitative data. The findings of the study are explained next.

Findings of the Study

Profile of the respondents (N=38)

- The respondents ranged between the ages of 18 and 25. The average age of respondents was 22 years.
- Thirty-one of the respondents were female and seven were male.
- The demographic representation consisted of 28 African, 9 Indian and 1 Coloured respondents.
- The respondents indicated that IsiZulu (25), English (3), Xhosa (2), IsiKhosa (1), IsiXhosa (1), Saiswati (1), Xitsonga (1) is their home language.
- Of the third year respondents 17 were registered for the Bachelor of Commerce degree, 1 for the Bachelor of Business Science degree and 6 for other degrees. Of the fourth year

respondents, 10 were registered for the Bachelor of Commerce degree and 1 for the Business Science degree.

Overview and motivation for setting up the Supply Chain Student Association (SCSA)

The SCSA was founded in 2014. It was an initiative by two third year students, who identified a gap between students' academic knowledge and broader industry knowledge. The founders' initial aim was to endeavour to bridge this gap by having two seminars per semester and inviting business representatives and past UKZN students working in the field of supply chain management to provide guest lectures.

The SCSA has a working committee that consists of six members, and 106 student members. Members include second year, third year and fourth year students registered for Supply Chain Management. This is an indicator of how receptive students are to this initiative and that the SCSA may well continue in the long term.

Does the SCSA benefit students?

Of the respondents (N=38), 36 indicated that the SCSA benefits them whereas 2 indicated that it does benefit them at all.

Main factors contributing to the success of the SCSA

Figure 1 presents the main factors that make the SCSA successful. It consists of eight nodes, of which seminars, site visits and creating interaction are the largest nodes.

Figure 1: Main Success Factors

Seminars

The findings reveal that 'seminars' is the **most important** category that contributes to the SCSA. The following are selected comments pertaining to seminars made by respondents:

"Seminars held by SCSA allow us to meet and network with people/mentors that have extensive knowledge."

"It creates an awareness about difficulties and opportunities by doing fieldtrips and seminars that create interaction between students and companies."

"Seminars that are regularly held, are most important because we can learn how SC is applied in the workplace."

"Their seminars and workshops are very informative. They are challenging and intellectually stimulating."

"It deals with issues that students (3rd year) are able to relate to and information gained at seminars and workshops helps with material from the classroom."

Create interaction

The findings reveal that 'create interaction' is the **second most important** category that contributes to the SCSA. The following are comments pertaining to seminars made by respondents:

"They engage with the industry that they will work at in the future merging reality and theory."

"It is engaging and informative."

"They help students engage in practical activities."

"It engages with students and helps prepare them for the job market by helping them with practical aspect of the operations field."

"The working together of the different sub committees in the association."

"It is interactive and encourages students to join and become a part of merging theory with reality. This makes supply chain more interesting and broaden views and understanding of supply chain."

Site visits

The findings reveal that 'site visits' is the **third most important** category that contributes to the SCSA.

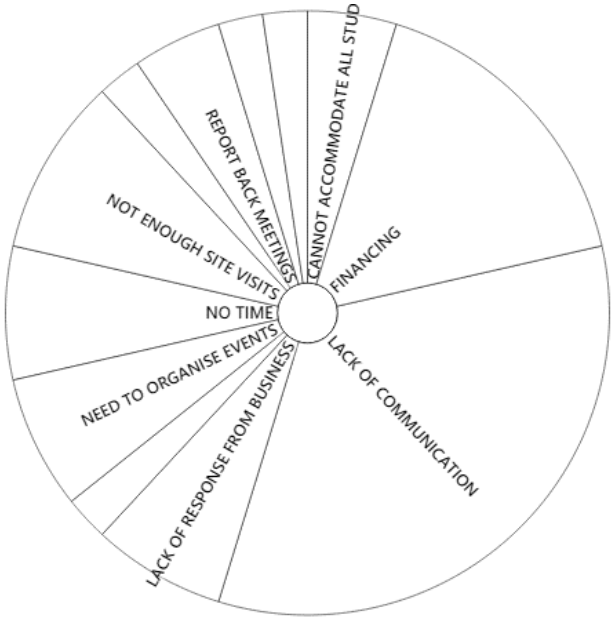
Figure 2 is a word cloud output on the various comments made by respondents on the main success factors of the SCSA. The larger terms/words are the most frequently mentioned.

Figure 2: Word Cloud output of various comments – main success factors of the SCSA

Main factors that limit the success of the SCSA

Figure 3 presents the main factors that limit the success of SCSA. It consists of twelve nodes, of which lack of communication and financing are the largest nodes.

Figure 3: Main limiting factors



Communication

The findings reveal that 'communication' is the most prominent limiting factor - the largest node. Some pertinent comments made by respondents pertaining to communication include:

> *"Lack of communication."*
>
> *"They need to make more students aware so that it can continue in the coming years."*
>
> *"Availability of information about itself."*
>
> *"Not enough people know about it."*
>
> *"They have low exposure."*
>
> *"It would have been more helpful to receive notification via emails sooner."*
>
> *"It is not marketed well in our camps."*
>
> *"Not many people know about the association."*
>
> *"The 2nd years are not exposed to the organisation. They know about its existence but not what it is all about."*

Financing

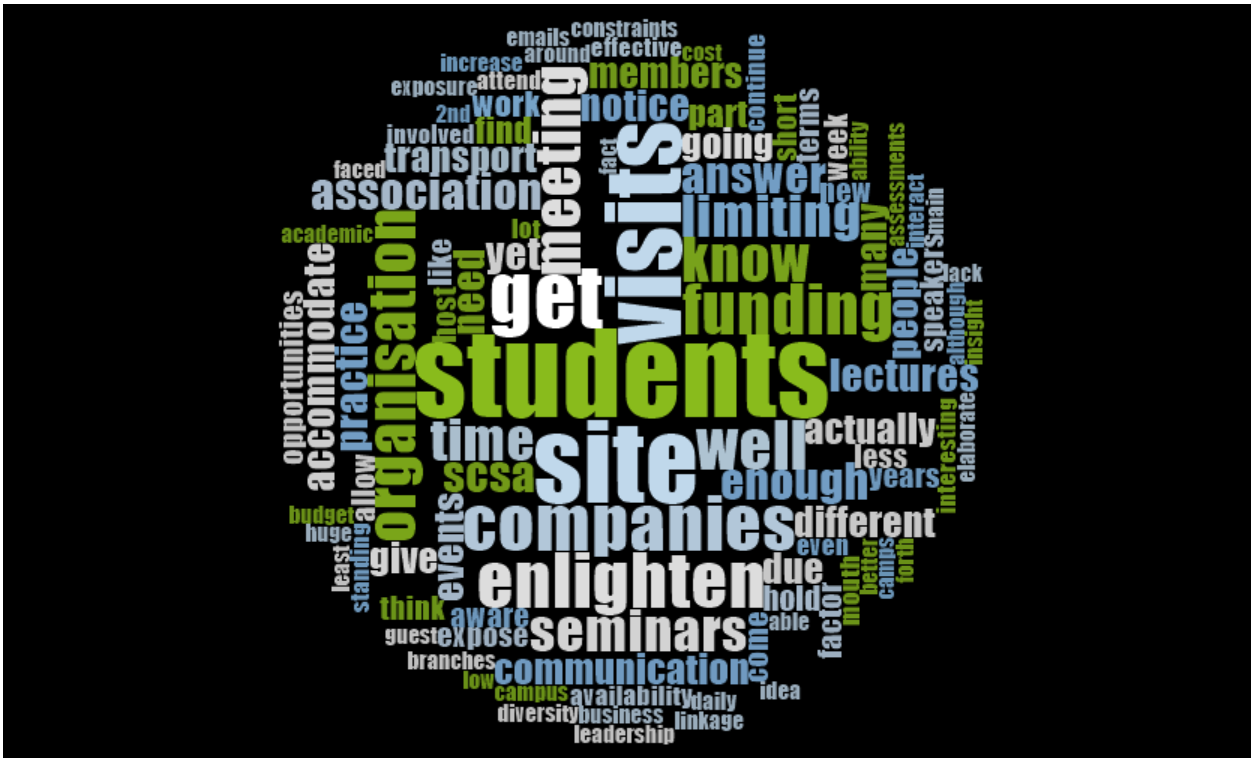
The findings reveal that 'financing' is the second most prominent limiting factor – the second largest node.

Some pertinent statements relevant to finance made by respondents are as follows:

> *"Less recognition by the finance department limits site visits for students."*
>
> *"They should get more funding to be able to hold more seminars and site visits as well as increase their communication and get more companies involved as guest speakers to enlighten us."*
>
> *"Not having enough funding to host as many seminars as possible to enlighten us and give insight from different companies to students."*

Figure 4 is a word cloud output on the various comments made by respondents on the main factors that limit the success of the SCSA. The larger terms/words are the most frequently mentioned.

Figure 4: Word Clout output of various comments – main factors that limit the success of the SCSA



Conclusion

The aim of this study was to provide an overview of the supply chain student association, and provide insight into the benefits and limiting factors of this association from the student's perspective and whether it has been successful in attracting students. However, the insights of the study should be viewed in terms of the limitations discussed.

The findings reveal that the main factors contributing to the success of the association, include seminars, the creation of interaction and site visits. The main factors limiting the success and effectiveness of the association, include lack of communication and financing.

It is anticipated that this paper will encourage the sharing of information about and of possible networking opportunities of other initiatives by students in the field of Supply Chain Management at tertiary level. This paper lays the foundation of a longitudinal study to determine the value added by the SCSA and the benefits and limiting factors thereof for the members going forward into the future. The SCSA is in its initial stages, having been founded in 2014, and its future sustainability will be monitored as well as the achievement of the objectives set by its founding members. It is also recommended that the establishment of a similar association be initiated on the Pietermaritzburg campus.

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Closing the circle: On the impact of intrapreneurship on circular purchasing

Petra Neessen[a], Marjolein Caniëls[a], Bart Vos[b], Jeroen de Jong[a]

[a] Faculty of Management, Science and Technology, Open University of the Netherlands, PO Box 2960, 6401 DL Heerlen, The Netherlands, petra.neessen@ou.nl, marjolein.caniels@ou.nl, jeroen.dejong@ou.nl, +31 45 576 2877
[b] School of Economics and management, Tilburg University, PO Box 90153, 5000 LE Tilburg, The Netherlands, b.vos@uvt.nl, + 31 13 4668293

Summary
The role of purchasers is changing in face of the challenge to adjust circular practices in the broader context of a transition towards a circular economy. Their role is changing towards a more strategic role in which purchasers should behave as intrapreneurs. Although the literature on intrapreneurship shows a relationship between intrapreneurial behavior and the development of innovations, the effect on circular purchasing has not been investigated. This survey research aims to clarify the relationship between intrapreneurship of purchasers and circular purchasing. In addition, we examine how this relationship is influenced by organizational citizenship behavior and level of function.

Keywords: intrapreneurship, circular purchasing, Organisational citizenship behaviour towards the environment (OCBE)
Submission category: working paper

Introduction

The transition towards a more circular economy is becoming relevant for an increasing group of organisations. Circular economy is defined as 'an industrial system that is restorative or regenerative by intention and design' (World economic Forum, 2015, p.15). The idea behind this is that linear systems are not sustainable. However, this transition is by no means an easy one. Not only is it often unclear what circular economy and circular purchasing entails, but moving away from existing structures is a difficult undertaking which requires an approach that differs from current practice (Ghisellini, Cialani and Ulgiati, 2016). Purchasers can play a major role in this trajectory, but in doing so purchasers need to have a more strategic focus instead of an operational focus (Crespin-Mazet and Dontenwill, 2012; Giunipero, Denslow & El Tantawy, 2005)

In literature, intrapreneurship is linked to innovative, proactive and risk-taking behaviour of individual employees that result in new products, processes and ventures (Antoncic and Hirsch 2003; Rigtering, 2013). It is referred to as entrepreneurship within an existing organisation (Antoncic and Hirsch, 2003). Based on findings from a literature review (Neessen, Caniëls, Vos & De Jong, 2017), a definition of intrapreneurship is proposed that includes the behavioural aspects of intrapreneurial employees and emphasises the multilevel nature of intrapreneurship: "Intrapreneurship is a process whereby employee(s) recognize and exploit opportunities by being innovative, proactive and by taking risks, in order for the organisation to create new products, processes and services, initiate self-renewal or venture new businesses to enhance competitiveness and performance of the organisation."

Intrapreneurship is a construct that connects the actions of an individual to positives outcomes for the individual, team and organisation. Intrapreneurship is a concept that directly links the

employee with the organisation and is therefore distinct from entrepreneurship (Neessen et al., 2017). The employee always acts within the structure of an existing organisation. Neessen et al. (2017) argue that the most commonly used combination of intrapreneurial behaviours, e.g. innovativeness, proactiveness and risk-taking, should be complemented with the constructs of internal and external networking and opportunity recognition.

Becoming more intrapreneurial is expected to increase the impact of purchasers on the level of circular purchasing within their organisation. However, it is not clear to what extent purchasers show intrapreneurial behaviour, because their role within organisations is changing. Furthermore, in the literature intrapreneurship has been linked to developing new products, services and ventures, but not specifically to conducting circular purchasing (Ağca, Topal and Kaya, 2012; Rigtering 2013). Therefore, this study aims to examine the relationship between the level of intrapreneurship of purchasers and the level of circular purchasing.

Circular economy and circular purchasing

Circular economy is a model that is an alternative to the make-take-waste model. The later model has several negative effects on sustainability of the natural system and therefor the sustainability of the economic model (Ghisellini et al., 2016). Circular economy strives to close the circle of materials and goods and eliminate waste as much as possible (Murray, Skene and Haynes, 2017). Still, it should be noted that designing and purchasing in a circular economy requires more than just waste management. A broader system perspective encompasses the entire life cycle of products and processes and its interaction with the environment and the economy. Circular economy is concerned with the creation of self-sustaining production systems (Genovese, Acquaye, Figueroa and Koh, 2017; Ghisellini et al., 2016). Ghisellini et al. (2016) reviewed the literature on circular economy and they found the following seven principles of circular economy, each with its specific challenges: Design, reduction, reuse, recycle, reclassification of materials and nutrients so that materials are designed to be reused at the end of the cycle or safely returned to the ecosystem, and renewable energy as the energy source. When designing products and its purchasing processes, innovative concepts alone are not enough. Actors involved should also be innovative in their work, whether these are purchasing professionals, R&D professionals or sales persons (Ghisellini et al., 2016). For example, purchasing professionals and supply chain managers need to work together with suppliers to gain access to the right materials and with end-users to ensure that the products or services can be reused or recycled (Genovese et al., 2017).

Purchasing professionals increasingly have a strategic position within the organisation to contribute to the bottom-up transition towards a more circular economy (Genovese et al., 2017). However, there has not been a lot of literature connecting circular economy with the role of purchasers, whereas, as mentioned before, the circular economy concept entails a new way of looking at products and requires a different design in which the principle of reuse, recycle and reduction are included (Ghisellini et al., 2016). New product development (NPD) might be essential in the transition towards a circular economy. Research shows that including purchasing professionals in the new product development results in a higher NPD performance (Nijssen, Biemans, de Kort, 2002). Hence, we focus on the purchasers and their (changing) role towards a more circular way of purchasing (Crespin-Mazet and Dontenwill, 2012; Giunipero et al., 2005).

Intrapreneurship and circular purchasing

The transition toward circular purchasing and the strategic role of purchasers within this transition require different behaviour from purchasers. They need to be innovative in the design of the product (in collaboration with R&D) and they need to be able to network with the

different actors involved, both inside and outside the organisation. This transition also involves some risks and not everyone in the market will be willing to changes. This implies that risk-taking and pro-activeness are behaviour needed for purchasers. These types of behaviour are all dimensions of intrapreneurship. In general, intrapreneurship is found to be positively related to performance (Baggen, Lans, Biemans, Kampen and Mulder, 2016). More specifically, intrapreneurship of purchasers is also positively related to the relationship quality between internal consumers and suppliers (Steward, Wu and Hartley, 2010). We thus expect that intrapreneurial purchasers will be able to contribute to the transition towards a circular economy, resulting in our first hypothesis:

> *Hypothesis 1: A higher level of intrapreneurship of the purchaser results in a higher level of circular purchasing*

Green behaviour, intrapreneurship and circular purchasing

Since intrapreneurship is linked to innovation, but not necessary green innovation, we expect that green behaviour of the purchaser also influences the percentage of circular purchasing. Organisational citizenship behaviour towards the environment (OCBE) is a type of green behaviour that is related to behaviour at work. OCBE is defined as voluntary and unrewarded environmental actions that go above and beyond the job requirements in an organisational setting (Temminck, Mearns and Fruhen, 2015). We hypothesize that purchasers with a high level of OCBE also have a higher percentage of circular purchasing (hypothesis 2).

In addition, some researchers point out that organisations need champions or 'green intrapreneurs' to increase their environmental performance and to assure that green initiatives create actual change in a product or a process (Andersson and Bateman 2000; Boiral and Paillé, 2012). In that line of thought, we expect that that intrapreneurship mediates the relationship between OCBE and circular purchasing (hypothesis 3).

> *Hypothesis 2: A higher level of OCBE of the purchaser results in a higher level or circular purchasing.*

> *Hypothesis 3: The level of intrapreneurship mediates the relationship between OCBE and circular purchasing.*

Methodology

An electronic survey was sent to purchasers in the Netherlands and Flanders (Belgium). Purchasers were contacted by a mailing through the Dutch and Belgian Purchasing Associations and via a message on a Dutch forum for purchasing professionals. In addition, the members of a Dutch group of purchasers of large companies were asked to promote this survey amongst their purchasing professionals. In total we received 124 usable responses, 27.4% from Flanders and the rest were Dutch. Also, 67.7% of them were male. The majority indicated that they worked in a strategical (44.4%) or tactical purchasing function (30.6%). Also 65.8% of the participants worked for a profit organisation in comparison to 34.2% that worked for a non-profit or governmental organisation (Table 1). We put several measures in place to increase the number of responses, such as a small financial reward if appreciated. After a couple of weeks, we also send out a reminder of the survey. The data was analysed anonymously.

Table 1 Sample characteristics

Characteristics of the respondents (n=124)	% of the sample
Nationality (n = 124)	
Dutch	72.6
Belgium	27.4
Gender (n = 124)	
Male	67,7
Female	32,3
Age in years (n=109)	
Younger than 30 years	4.6
31-39 years	21.1
40-49 years	34.9
50-59 years	35.8
60 years and older	3.7
Type of organisation (n=111)	
Non-profit	34.2
Profit	65.8
Level of function (n=124)	
Operational purchasing	6.5
Tactical purchasing	30.6
Strategic purchasing	44.4
Manager	13.7
Director	4.8
Educational level (n=122)	
Secondary general education	7.4
Secondary vocational education	12.3
Higher education	43.4
Scientific education	36.9

Questionnaire

The survey consisted of a number of questions related to the behaviour of purchasers and their level of circular purchasing. Based on a literature review of Neessen et al. (2017) we used the constructs opportunity recognition, internal and external networking as well as the constructs of innovativeness, pro-activeness and risk taking to measure intrapreneurship of purchasers. We combined several scales measuring these concepts to construct a more complete measure of intrapreneurship. For innovativeness, proactiveness and risk-taking we used a scale adapted by Fellnhofer, Puumalainen and Sjogren (2016) (Bolton, 2012; Langkamp, Bolton and Lane, 2012), for opportunity recognition we used a scale of Wang et al (2013) and the scale of Chen et al (2015) was used to measure networking. The combination of these scales resulted in 24 items measuring the sub concepts of intrapreneurship. A confirmatory factor analysis showed a good fit and legitimised the use of this combined measure for intrapreneurship, with the exception of pro-activeness and one item of opportunity recognition which had a low reliability

score. Organisational citizenship behaviour towards the environment (OCBE) was measured using a scale of Temminck et al. (2015) consisting of 7 items. The scales of intrapreneurship and OCBE were indicated with a 5-point Likert scale.
The dependent variable was the percentage of circular purchasing. The participants were asked to indicate what percentage of their purchasing was purchased in a circular manner. Before we asked this question, we explained the construct of circular economy, which we described as: 'a system in which the circle of products and materials is closed and that waste is minimized'. We also asked for a number of control factors, such as type of function, type of organization, age, gender and educational level.

Analysis
The data was analysed with a mediation analysis using the process template of A. Hayes in SPSS (Hayes, 2013), in which intrapreneurship was the mediation variable, circular purchasing the dependent and OCBE the independent variable.

Results
Reliability analysis show a low reliability of the subscale pro-activeness (α=.337). The opportunity recognition scale also had a low reliability, but after excluding item 3 the reliability increased to an acceptable alpha ((α=.642). The other scales innovativeness (α=.789), risk taking (α=.664), internal networking (α=.869), external networking (α=.714) and OCBE (α=.893) were also reliable. A confirmatory factor analysis showed a good fit (RSMEA = .056; CFI = .922; TLI=.908) and legitimised the use of this combined measure for intrapreneurship, with the exception of pro-activeness and one item of opportunity recognition which were deleted from analysis due to the low reliability score (Schreiber, Nora, Stage, Barlow, and King, 2006).

Circular purchasing
The respondents were asked to indicate the level of circular purchasing, operationalized as the percentage of their purchasing budget used for circular purchasing. The results show that the level of circular purchasing is quite modest. The average percentage of circular purchasing in comparison to the total purchasing budget available per participant was just over 15% and around 26% of the respondents said that they had (nearly) zero percent circular purchasing (Figure 2). This implies that there is still a long way to go in order for all purchasing activities to become circular.

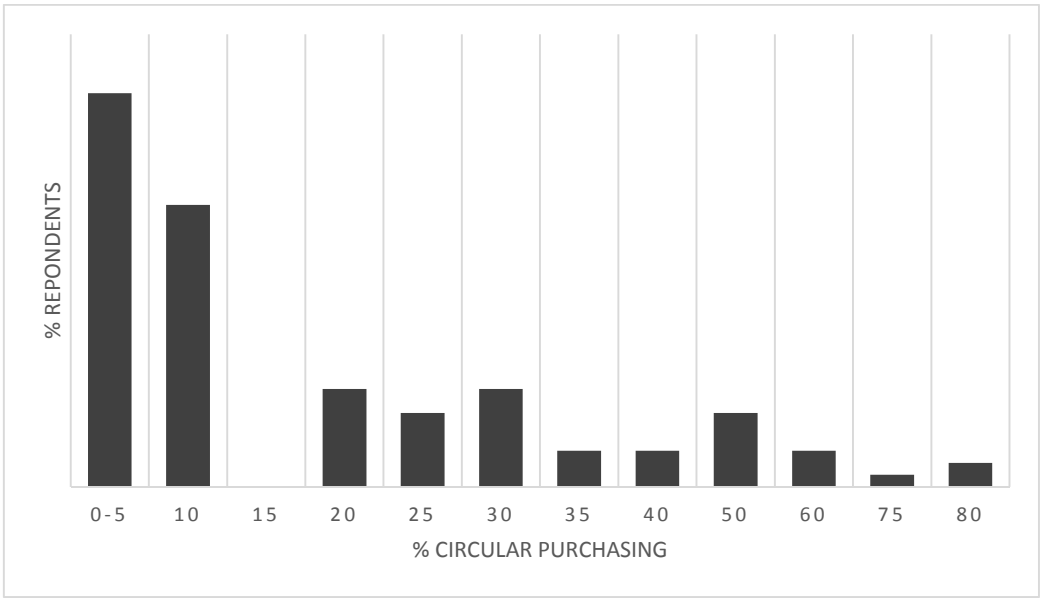

Figure 2. The level of circular purchasing (n=123)

Relationship between intrapreneurship, OCBE and circular purchasing

The correlation analysis (see Table 2) reveals that OCBE and intrapreneurship were correlated, but there was no indication of multicollinearity. Moreover, we did find that the control variables 'type of organization', age, gender and educational level were not correlated with the three main variables (OCBE, intrapreneurship and circular purchasing), except for the level of function. The dummy variable level of function was positively and significant related with intrapreneurship. Therefor we included this variable as a possible moderator in our further analysis.

Table 2 Correlation matrix

	Variables	**Mean**	**s.d.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	Intrapreneurship	3.91	.38							
2	OCBE	3.32	.68	.31**						
3	% circular purchasing	15.74	18.25	-.10	.04					
4	Type of organisation (non-profit 1; profit 2)	1,66	.48	-.03	-.11	.19				
5	Level of function (high 1; low 0)	.63	.48	.23*	.04	-.11	.09			
6	Age group (5 groups)	3.13	.94	.02	.02	-.16	-.01	.10		
7	Gender (male 0; female 1)	.32	.469	-.02	-.06	.03	-.25**	-0.11	-.14	
8	Education level (5 groups)	4.06	.10	.07	-.02	-.14	-.07	.28**	.05	-.02

Notes: n = 124. * $p < .05$, ** $p < .01$

The results of the regression analyses are shown in table 3. We did find a positive relationship between OCBE and intrapreneurship (b = .184; p < .05), but no effect of intrapreneurship on the percentage of circular purchasing. The direct effects of OCBE and level of function were negatively significant (respectively b = -9.303; b = -56.579). However we found that these variables interacted with each other (b=16.022; p<.01).

Table 3 results of the regression analysis.

	Model 1 (dependent variable: percentage of circular purchasing)
Independent variables	
Direct effects	
Intrapreneurship	-5.503
OCBE	**-9.303***
Level of function	**-56.578****
Interactions	
OCBE x Level of function	**16.022****
Conditional indirect effects	
Low level function	**-9,304***
High level function	**6,719***
R^2	.099
F-Value	3.206
N	124

Notes. * p < .05, ** p < .01.

When examining this interaction effect, we found a conditional direct effect of level of function on the relationship between OCBE and the percentage of circular purchasing. Purchasers in a higher function (e.g. strategic, manger or director) showed a positive relation between OCBE and circular purchasing and purchasers in a lower level function (e.g. operational and tactical) a negative relationship (see Figure 2). Further research is needed to analyze why purchasers in a lower level function and with a low OCBE score appear to purchase more in a circular manner.

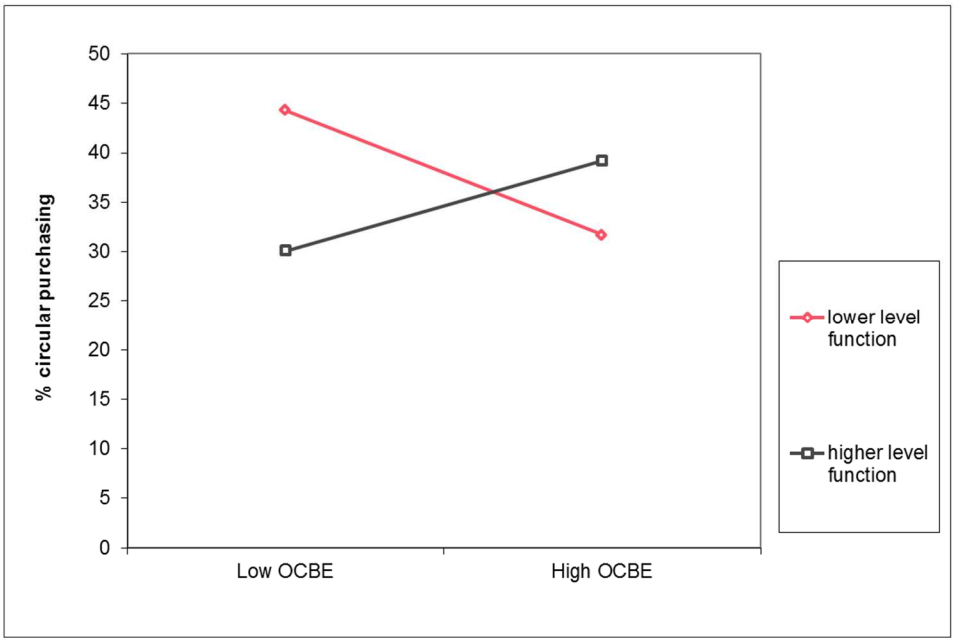

Figure 2. Conditional effects of level of function and OCBE on the percentage of circular purchasing.

Discussion, limitations and conclusions

Our results show that we need more research into the (intrapreneurial) behavior of purchasers leading towards more circular purchasing and how different personal and organizational factors could influence this relationship. Our study did yield some initial results on this relationship.

Firstly, the level of circular purchasing by the purchasers in our survey was low. This could indicate that circular purchasing and also circular economy is still a concept that is used in the communication of the organization and not (yet) find its way into the processes of the organization. More specifically, the views and goals of the organization communicated towards the outside market are not in alignment with the inner organization. Previous research indicates that the alignment of the processes with the top-management strategy is positively related to the effectiveness of sustainability incentives and as an indirect result sustainable performance (Parisi, 2013). Another explanation for this low level of circular purchasing could be that the concept of circular purchasing is still difficult to interpret. Even though we did state in the question that we define circular purchasing as purchasing based on the principle of circular economy which is a system in which the circle of products and materials is closed and that waste is minimized, the actual practicality of this system might still not be entirely clear. Circular economy entails much more than just purchasing sustainable products. It also means that the purchasers have to be aware what happens with the product or material after the product has been used. This aspect of circularity entails a much more intensive role of the purchasers that has to work with suppliers, logistics, recovery specialist and the end users to complete or ensure the life circle of the product or material. In order to do that, it must me clear for all parties involved what circular economy is and how it could be brought into practice. Based on our results, we think that the 'vagueness' of the concept results in a high perceived risk factor and uncertainty for the actors involved. Subsequently, the step to actually purchasing in a circular manner is too high, even for the intrapreneurial purchasers who might accept a higher risk and uncertainty of projects. This might also explain the lack of results regarding the relationship between intrapreneurship and circular purchasing. Future research could test what the barriers are when implementing circular purchasing. Does the alignment of the organization and the inner processes play a role, or is the risk factor and the uncertainty that the concept of circular economy entails too high for the actors involved?

Second, we find a positive relationship between OCBE and intrapreneurship. This was expected because OCBE entails behavioural actions that go above and beyond the job requirements (Temminck et al., 2015). Going above and beyond your job requirements entails some risks and extra work that would also be behavioural dimensions of intrapreneurship. It could be concluded that purchasers that show a high level of OCBE and thus go the extra mile for environmental friendly actions, are also more intrapreneurial. The results regarding the relationship between OCBE and circular purchasing are more difficult to explain. As hypothesized we find a positive relationship between OCBE and circularity, but only for the purchasers in a higher level function. For the purchasers in a lower level function, we find the opposite effect. Hence, this effect of function type is an interesting future research direction. One explanation could be that the level of support by the management perceived by the purchasers of a lower function might be different from the purchasers in higher level functions. Management support is an organisational factor that enables employees to behave in a more sustainable way (Brinkhurst, Rose, Maurice and Ackerman, 2011). Another study showed that the status of the purchasers influences the level of sustainable purchasing (Luzzini and Ronchi, 2016). Purchasers in a lower level function may have a lower status within the organisation,

which may explain that regardless of their own level of OCBE, they perceive they cannot enhance the level of circular purchasing.

There are some limitations to this study. We contacted a high number of purchasers via several routes. Unfortunately these routes were mostly indirect via networks or via purchasing associations. This might be the reason the total number of usable responses was low. We advertised the survey by addressing the changing role of purchasers. We specifically withheld from mentioning circular purchasing in the opening statement of the survey. This was done to assure that purchasers who work in organisations that are not really 'sustainability minded' also felt inclined to participate. Still, this decision did not appear to increase the response rate. We also included both profit and non-profit organisations in our research sample. Although we did not find any effect of type of organisation on the results, we realise that the purchasing process of purchasers working in a non-profit environment is different from the processes of purchasers working in a profit organisation.

In conclusion, we found that the level of circular purchasing is much lower than expected. This might be the reason why we did not find a significant relation between intrapreneurship and circular purchasing. However we did find a positive relationship between OCBE and intrapreneurship and a positive relationship between OCBE and circular purchasing amongst purchasers in a strategic, manager or director function and surprisingly a negative relationship between OCBE and circular purchasing amongst purchasers working in a lower function (operational and tactical function). This study could be the basis for future research towards circular purchasing and the role of the purchasers.

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CONTRACTING STRATEGIES IN CAPITAL CONSTRUCTION PROJECTS
(A structured literature review)

Anna Nikulina (nikulina@rsm.nl), Finn Wynstra (fwynstra@rsm.nl)
Rotterdam School of Management

Summary: Capital construction projects are characterized by high levels of outsourcing, as project owners rarely have resources to complete the design and manage/perform the construction process. Thus, a choice of a project delivery and contracting strategies (i.e. scope of work, payment type and risk allocation) is a crucial task for the sector. Recognizing its importance, academics have investigated project delivery and contracting approaches over the years; however, no systematic existing research review on the topic has yet been completed. The present article reports on the first literature review effort and identifies opportunities for the future research.

Key words: contracting strategy, risk allocation, construction

Introduction

Capital construction projects are characterized with high levels of outsourcing, as project owners rarely have all necessary resources to complete the design and manage/perform the construction process. Thus, the influence that suppliers and contractors have on the outcome of construction projects is very significant (de Araújo, Alencar, & de Miranda Mota, 2017); the choice of an effective project delivery approach and contracting strategy is key for the project owners.

Oyetunji and Anderson (2001) define the project delivery and contracting strategy (PDCS) as follows: "The way the … tasks in a particular project are packaged for execution, and the types of services that the owner retains for the execution of those tasks define the delivery system ... Complimentary to the delivery system is the contract strategy … <that> defines how the owner pays for the services rendered by service providers ... This implicitly defines the allocation of financial risks between the owner and the service providers" (p.1). PDCS choice is contingent on various circumstances such as project product/process uncertainty, desired risk allocation, owner's characteristics and capabilities, as well as market conditions (Liu, Huo, Shen, and Yang, 2015; Suprapto, Bakker, Mooi, and Hertogh, 2016).

Recognizing the importance and relevance of PDCS, researchers have studied various aspects this complex phenomenon. Just to name a few studies, a comparison of project delivery approaches was completed by Liu et al. (2015); Ward and Chapman (1994) conceptualized pricing mechanisms; partnering approach was examined by Eriksson (2015); Iossa and Martimort (2012) investigated risk allocation in PPPs. The existing research is mainly concentrated in the engineering & construction management (ECM) and project management (PM) literature; and to a lesser extent in the operations and supply chain management (OSCM) research, that has typically focused on series manufacturing context, with some exceptions (e.g. a 2010 special issue of Journal of Purchasing and Supply Management devoted to the construction industry studies).

Despite the obvious interest of scholars in the PDCS topic and its high relevance, there has been no previous attempt to review and systemize the academic research related to it. Thus, we may lack a clear view which important questions have been under-investigated. E.g., application of incentive or risk allocation seem to have attracted attention of many scholars; other questions, such as comparison of single- versus multi-contracting approach, have been studied to a very limited extent (with exceptions such as Rojas (2008), or Mogre, Talluri and D'Amico (2016). There

is also an issue of multiple definitions developed over time and in different countries: e.g., "project delivery approach" can be named "procurement route" or "contract strategy", "contract pricing" means the same as "payment type" or "contractor compensation scheme", "risk allocation" can be "risk apportionment" etc.). Finally, we perceive that the existing literature, although extensive, is rather fragmented: e.g. construction management scholars do not necessarily draw from OSCM sources (based on citations), and vice versa.

Thus, we believe it will be valuable to undertake an effort to systemize the existing literature about PDCS by combining strands of the construction, project management and OSCM research (and potentially identifying other fields that have interest in this question). We aim to uncover main topics, trends, and future research needs; as well as provide a critical review of the current state of the PDCS studies (De Araújo, et al., 2017).

Classification of studies related to PDCS

Based on our familiarity with the topic and the initial literature investigation, we divided studies of the PDCS phenomenon into three parts (See Figure 1 below).

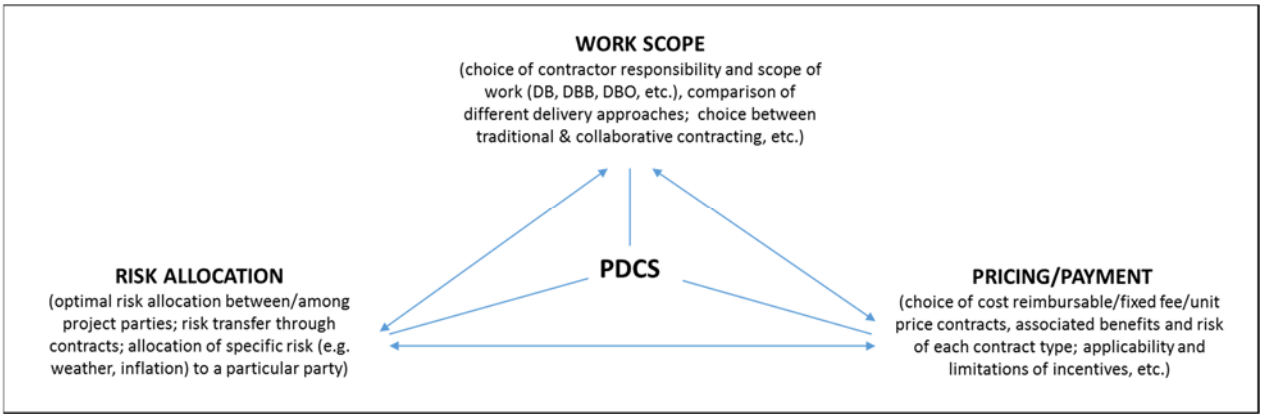

Figure 1: PDCS components and associated research topics

The first part (and related studies) covers questions about how the project work scope is allocated among the parties over the project phases (design, engineering, procurement, construction). These questions relate to the part of PDCS commonly called "***project delivery***".

We chose to split the second part, traditionally referred to as "***contracting strategy***", into two separate topics: pricing/payment and risk allocation. Although the definition of PDCS above states that these questions are inherently connected, there are two distinct groups of studies related to them. Enquiries related to the problem of how contractor(s) should be paid often discuss the allocation of risk, however, in such studies risk is understood at a very high level, mostly as general risk of financial losses resulting from the project schedule/budget overrun (Ward and Chapman, 1994; Turner, 2004; Turner and Simister, 2001). At the same time, the problem of project risk allocation is also investigated at a more granular level in a separate group of studies; general "project" risk is broken down into particular categories, such as weather, government, raw material price fluctuations, etc. (typology varies depending on the author approach). Such studies are not necessarily connected to the question of type of pricing/payment in the contract, but focus particularly on which type of risk should be allocated to a certain project party for the overall minimization of risk (and thus cost/schedule) of the project.

Our ultimate objective is to provide a systematic review of the studies that relate to PDCS research. However, given the complexity of the task and a large body of literature (our search identified ~400 articles that need to be fully read and coded), this working paper reports on the first

part of the project and covers studies related to contracting strategies: pricing/payment and risk allocation questions. Following the approach suggested by Cooper (1998), Seuring and Muller (2008), Fink (2013), we organize the rest of the paper in the following way: fist, we describe the approach and the process of material collection; next, we offer a descriptive analysis of the articles. Finally, we perform evaluation of the collected material and present our interpretation and findings.

Method

Coding sheet, approach and classification categories

Cooper (1998) recommends developing the coding sheet prior to search and analysis of the literature begins, as it helps to identify how the search should be designed and which information needs to be retrieved from the collected material. The initial draft of the coding sheet was developed by the first author; it was discussed and by both authors and refined; after test-coding of 20 articles it was revised again, and additional fields were added (e.g. owner/contractor view, project ownership type, etc.). The full list of applied classification categories is in the Table 1 below.

Table 1. Classification categories used in the coding sheet (final version)

Classification categories	
Basic categories	Title, authors, publication year, journal, abstract, RQ/intended contribution, findings
Relevance	Yes, no, partial (partial if the question of risk allocation or contract payment/pricing is not the only one discussed in the article, but still substantial enough to include it in the review)
First and second level codes	First level (scope, pricing, risk, combined, other-specify); second level (open list to allow for the broad list of included subtopics, e.g. particular contract payment type, etc.)
Project ownership	Ownership type (public, PPP, private, not specified)
Project delivery type	DB, DBB, DBO, DBOT, EPC, EPCm, Turnkey, alliance, relational, cooperative, other-specify, not specified
Payment/pricing type	Fixed price, cost plus, incentive, unit price, other – specify, not specified
Publication type	Non-empirical conceptual (NEC), non-empirical modelling (NEM), empirical, mixed
Research strategy	Literature review, case study, survey, secondary data analysis, interviews, experiment, mathematical modelling (MM), mixed, not available (N/A), not applicable (N/A)
Data analysis method	Quantitative, qualitative, mixed
Intended contribution type	Theory building, testing, exploratory, prescriptive, mathematical modelling, N/A; contribution explicit/implicit (implicit – if not discussed, but identifiable from the text)
Theoretical lens	Open coding (name of theory that is mentioned or used; none; N/A)

Main definitions and search keywords for the literature search

According to Ward and Chapman (1994), main types of contracts applied in construction are fixed-price, cost plus fixed fee, incentive. Carty (1995) classifies contracts into lump sum (fixed price), unit price, guaranteed maximum price, and cost reimbursable. Turner and Simister (2001) differentiate between fixed price, remeasurement and cost-plus agreements; Van der Puil and Van Weele (2013) use the list of fixed-price, cost-reimbursable (including target cost and incentive) and unit-price, but call this classification pricing mechanism rather than payment type. "Risk allocation" can also be "worded" in a several ways, e.g. . it can be named "risk sharing" (Carpintero and Petersen, 2015), or "risk transfer" (Bayley, 2003; Burke and Demirag, 2017) – depending on the specifics of the research question and exact focus/topic.

Based on the identified terminology, our initial list of search terms/keywords was as follows: "fixed price contract*", "lump sum contract*", "incentiv* contract*", "unit price contract*", "cost reimbursable contract*", "cost plus contract*", "remeasurement contract*", "target cost contract*","guaranteed maximum price contract*", "contractor* payment*",

"construction contract* pric*", "project risk*", "construction risk*", "risk allocation", "risk sharing", "risk transfer", "risk apportionment".

Information sources and material collection

As there are no prior systematic reviews about the topic of interest, our aim was to cover as large a time interval as possible: we searched for the academic literature from 1975 to 2017. We settled on the year 1975 as search in Web of Science (WoS), the main citation database that we used, goes back to 1975. We chose WoS, as it covers a wide range of journals across the disciplines of our interest (Rashman, Withers, and Hartley, 2009). To ensure consistent quality and possibility for an adequate analysis of the literature, we decided to include in our search only original academic publications from peer reviewed academic journals published in English. Although our primary goal was to include the research in ECM, PM and OSCM strands, we did not limit search to the journals in these categories; understanding what other fields/disciplines are interested in this topics and what is their contribution, is necessary for a systematic literature review.

We undertook three steps to identify relevant publications in the WoS search results. First, we read all titles and their sources, and excluded clearly irrelevant articles. Next, we read all abstracts and further refined our list. Finally, we excluded some more articles after examining the full text (during the coding process). While doing the screening of WoS search results, we found some more relevant keywords, and performed additional searches, e.g. on "incentive/disincentive contract*", or "risk/reward". Our WoS search resulted in 122 relevant original research articles included in the review (56 related to payment/pricing, 66 to risk).

Given a very broad terminology in the topic and a risk to miss relevant publications, we additionally examined all article titles in all volumes/issues of six key journals in the area of interest, as recommended by Rashman et al. (2009). Five key journals in the field of project and construction management were searched (Naoum and Ebgu, 2016): International Journal of Project Management; Journal of Construction Engineering and Management; Engineering, Construction and Architectural management; Journal of Management in Engineering; Construction management and Economics. We added Journal of Purchasing and Supply management to the list as the leading journal in the PSM field. This search added 13 articles to our list (8 related to payment, 5 to risk).

Finally, we checked references of the articles found through the WoS and key journal search. We also came across two publications that contained comprehensive lists of literature related to contract (payment/pricing) types - Antoniou, Aretoulis, Konstantinidis, and Kalfakakou, (2013) and incentive contracts - Kerkhove and Vanhoucke (2016). The reference search approach added 23 more articles to our list (19 for payment/pricing, 4 to risk).

The present article contains analysis of 158 publications (83 – related to payment/pricing, 75 to risk). A full search protocol and list of references can be obtained from the first author.

Descriptive statistics

Although our literature search started from 1975, we were not able to identify any relevant publications prior to 1980; since then, we see a continuous growth in the interest to topic, as the number of publications related to contracting strategies has been increasing (see Figure 2 below).

We split all the identified journals into four categories based on Nauom and Egbu (2016) and our own approach. The largets share of the articles (62%) is concentrated in the journals that publish research in the ECM field, as can be seen in Figure 3 below. Substantial number of publications was found in PM literature (22%), while interest of OSCM to the studies of construction contracts is limited (only 5%). The final 13% of articles related to the topic were found in the journals that we classified in "Other" category, as they do not belong to any of the three research strands mentioned above.

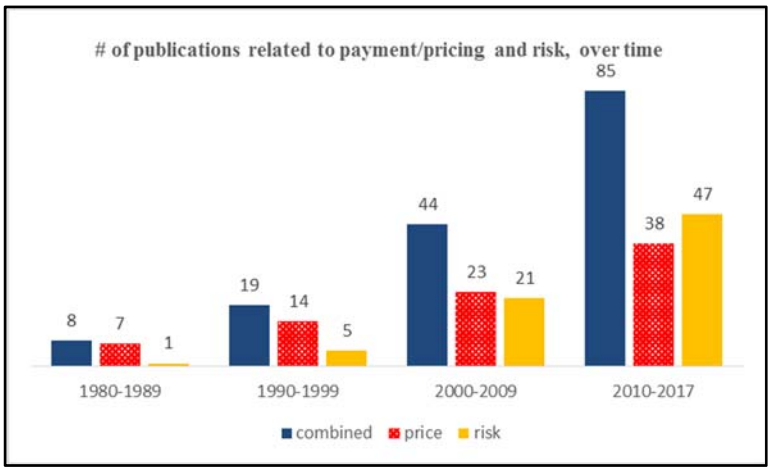

Figure 2. Number of publications related to the payment/pricing and risk components of contracting strategy

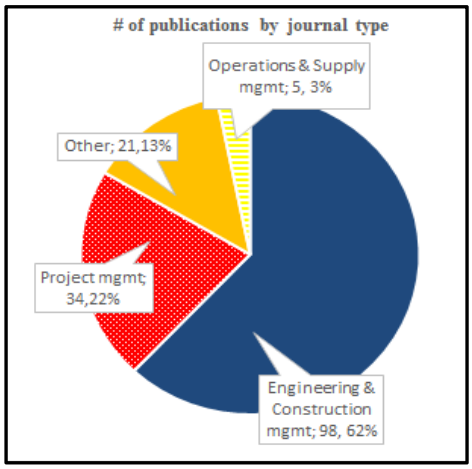

Figure 3. Number of publications by journal field

Out of 158 publications 58 (37%) are non-empirical (39 conceptual and 19 mathematical modelling studies), 12 (7%) were classified as mixed; 88 (56%) apply empirical methods. Trends over time can be seen in Figure 4 below. A total of 96 (61%) papers apply quantitative data analysis methods; 18 (11%) articles combine quantitative and qualitative approach, and 43 (28%) are qualitative. Survey is a preferred research strategy (46 papers, 29%), however, in many cases the collected data analysis is limited to descriptive statistics. Surveys are followed by the mathematical modelling (41, 26%) and case studies (23, 15%). In ~ 30% of cases researchers applied more than one method of scientific enquiry. See Table 2 below for more details.

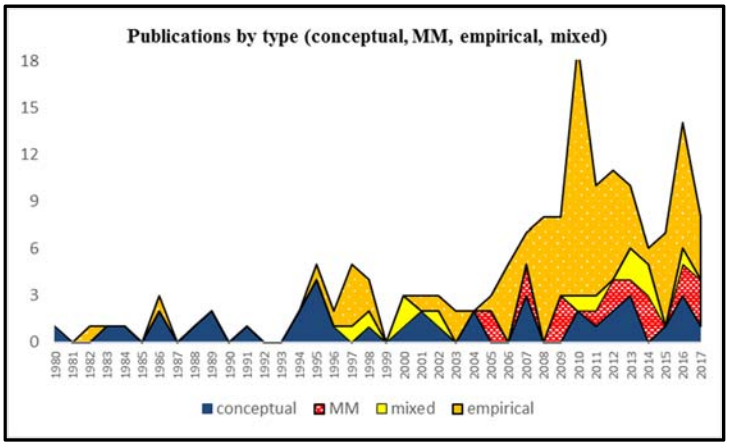

Figure 4. Number of conceptual, mixed and empirical papers on contracting strategies, over time

Table 2. Applied research strategies

survey	46	29%
mathematical modelling (MM)	41	26%
case study	23	15%
N/A	15	9%
survey + MM	8	5%
case study + survey	5	3%
secondary data analysis (SDA)	5	3%
interviews + survey	3	2%
case study + MM	2	1%
interviews	2	1%
literature review (LR)	2	1%
case study + SDA	1	1%
interviews + SDA	1	1%
interviews + case study	1	1%
interviews + MM	2	1%
systematic LR + survey	1	1%

Out of 88 empirical papers 32 (38%) collected (or used secondary) data from Asia, 27 (30%) from Europe, 12 (14%) from Australia, 11 (13%) – Americas, 5 (5%) from Middle East, and 1 (1%) – Africa. Empirical researchers investigate different types of projects in terms of ownership: 39 (25%) papers focus on PPP, 18 (11%) study public procurement, 4 (2%) combine data from public and private projects; however, many articles do not specify ownership type, or

data potentially comes from various types of projects in case of survey methods applied. Only 34 papers clearly reported in which construction sub-sector data was collected, and in 29 cases it comes from the infrastructure sector (water, rail, roads).

We faced a challenge in determining the theoretical contribution of many papers; only in 18 articles (11%) the authors explicitly attempted to build new or test an existing theory. We classified the rest of papers based on our understanding of their purpose/contribution. We divided the remaining 140 papers into the following categories: theory building (31, 20%), testing (24, 15%), modelling (33, 21%), exploratory (45, 29%) and prescriptive (7, 4%).

We found that research on the topic of contracting strategies is highly under-theorized: 116 papers out of 158 (73%) do not use or even mention any theoretical lens. In 33 cases authors clearly used at least one theory, and in 9 it is possible to identify it implicitly. Agency theory was explicitly mentioned in 17 publications, Transaction cost economics – in 12. Other applied theories include Contract theory, Utilities theory, Game theory, Price options theory, Resource-based view. However, even in those papers that used a theoretical background, in quite some cases it is limited to borrowing certain underlying assumptions or concepts (e.g. "bounded rationality" from TCE, "moral hazard" or "adverse selection" from Agency theory), rather than fully investigating a research question from a certain theoretical perspective.

Literature analysis – main topics

As we initially separated research related to payment/pricing and risk allocation questions (see above), we will present analysis of the literature separately: first for 83 papers related to payment/pricing, then for 75 publications focused on risk allocation problems.

Contract payment/pricing - conceptualization

Several "classic" articles conceptualize the choice of contract payment/pricing type. Veld and Peeters (1989) offer a decision framework for the contract types (fixed price, cost-reimbursable or incentives) based on several factors that include cost, schedule, technical uncertainty, etc., and include the contractor view in their decision framework. Ward and Chapman, 1994; Chapman and Ward, 1994 also discuss fixed price, cost reimbursable and incentive contracts; the choice of the contract payment type, according to them, should be based on the owner's desired risk allocation. Turner and Simister, 2001; Turner, 2004 add the re-measurement and alliance contracts to the list, and claim that the contract should be chosen to align interests of client and contractor. An attempt to optimize the choice of payment mechanisms using modelling was undertaken by Motawa and Kaka in 2009.

Particular contract types: fixed price, cost-reimbursable, convertible, incentive.

Griffis and Butler, 1988 conceptually argue for the advantages of cost-plus contracting; Smith, 1997 discusses positive implementation results of cost-plus contracts based on case studies in Canada; Rosenfeld and Geltner, 1991 offer conceptual arguments of disadvantages of cost plus and incentive contracts. However, in the later literature the focus largely shifts to studies of incentive contracting (see below). There is one conceptual publication (Carmichael, Karantonis, 2015) devoted to convertible contracts that allow for changing the payment type over the contract duration. We have not identified empirical studies related to this contract type.

Studies of incentive contracts constitute the largest share of articles in pricing/payment literature; this is why we chose to further divide it into two sub-topics. First, there are papers that study application of incentive mechanisms in construction contracts in general. Stukhart (1984), Herten and Peeters (1986), Bajari and Tadelis (2001), Bower et al. (2002) conceptualized the applicability of incentives and incentive contracts in the construction contracts, and discussed their benefits and limitations. Empirical research by Meng and Gallaher (2012), Bubshait (2001),

Bogus et al (2010), Suprapto at all (2016) focused on finding the effect of financial incentives and incentive contracts on the project results. Rose and Manley (2010) investigated the success drivers of financial incentives' implementation, and the effect of incentives on contractor's motivation, as well as its limitations. Hosseinian and Carmichael (2013) attempted to design an optimal incentive contract for the cases of risk-neutral contractor; another attempt to model the optimal incentive contract design was undertaken by Kerkhove and Vanhoucke in 2016.

The second group of articles focuses on a certain type of incentive contract: guaranteed maximum price/target cost (GMP), incentive/disincentive (typically schedule-oriented), and cost-plus-incentive-fee (CPIF) agreements. GMP contracts in particular are well covered in conceptual (Perry and Barnes, 2000; Lahdenperä, 2010, 2016 a,b) and empirical research. Risk ranking and allocation in these contracts, as well as benefits of GMP contracts were empirically studied by Chan et al. (2010, 2011, 2012) and Laryea (2016); sharing ratios discussed by Broome and Perry (2002), and Badenfelt (2008). CPIF contracts were both conceptualized and empirically studied by Berends (2000, 2006, 2007) and Al-Subhi Al Harbi (1998). A separate body of literature developed around a specific type of contracts applied in the road construction –incentive/disincentive (I/D) contracts. Some authors focused on analysis of the success factors of such contracts and developing guidelines for their application: Jaraiedi at al, 1995; Bayraktar and Hastak (2009), Choi and Kwak (2012) attempted to build a decision support model for incentive/disincentive contracts. Design of incentive provisions in I/D contracts was empirically studied by Arditi et al., 1997 and Ardity and Yasamis, 1998, Shr and Chen, 2004.

Connection of payment/pricing to the work scope/project delivery method

A limited number of papers investigates payment types in connection to a certain project delivery/work scope type. Bresnen and Marshall, 2000, Ling et al. 2006 focus on incentives in the alliance contracts. Cheng et al., 2016 study the appropriate payment types in design-build contracts, Love et al (2011) focus on suitable payment mechanisms for alliances; Berends (2006) discusses applicability of CPIF contracts in Engineering, Procurement, Construction management (EPCM) project delivery. We expect to discover more studies on this question in the second part of our project , when analyzing literature that we classified as "project delivery".

Publications focused on risk allocation

Overall this literature is dominated by the topic of optimization – either in an attempt to find opinions on the optimal risk allocation from various project parties, or to build mathematical models to reach best possible project risk allocation. Conceptual qualitative papers are rather an exception, e.g Barnes (1983), where a qualitative algorithm for risk allocation is offered. The majority of risk-related papers are quantitative, even if they are aimed at theoretical questions such as critique of agency-based principal-agent approach in risk allocation (Chang, 2014).

Risk identification, assessment and allocation preferences

A large share of papers (22 out of 75) focuses on identifying preferred risk allocation among project parties in PPPs. Such studies have been conducted in China (Chang et al (2011); Xu et al. (2011)) Indonesia (Wisbowo and Mohamed (2010), UAE (Sayegh and Mansour (2015)), Taiwan (Wang and Chou (2003)), Australia (Loosemore and McCarthy (2008); Perez et al. (2017)), and also Iran, Hong Kong, Singapore, Malaysia, Greece, etc. These studies use similar design: literature review and preliminary expert interviews to develop a list of relative risks for the questionnaire, then survey pilot testing with a group of experts, its refinement and finally the survey. They also typically report on opinions of clients, contractors and sometimes consultants and subcontractors, investigating their risk assessment and allocation preferences, and differences

in opinions among the groups of respondents. Sometimes a comparison of actual and desired risk allocation is added to the scope.

Modelling optimal risk allocation

The second dominant type of papers (17 out of 75) uses mathematical modelling methods to offer a methodology for optimal risk allocation: Lam et al., (2007); Jin and Zhang (2011); Nasirzadeh et al. (2016); Li et al. (2017). There are several attempts to translate the qualitative risk assessments into mathematical methods through fuzzification of qualitative inputs, such as Xu et al. (2010); Khazaeni et al. (2012); Nasirzadeh et al. (2014), Valipour et al. (2016).

There is not any other dominant topic in the risk allocation papers. Several publications discuss the cooperative (or joint) approach to risk allocation and management, and are connected to alliance contracting: e.g. Rahman and Kumaraswamy (2002); Witt and Liias (2010); Hanna et al. (2013); Osipova (2015). Some papers study the question of risk allocation in the contract texts/clauses (William and Ashley (1986); Hartman and Snelgrove (1996); Hartman et al. (1997)). Two recent articles address a question of how risk allocation affects relationship among project parties, and thus build a bridge into topic of interplay of contractual and relational governance (Burke and Demirag (2017); Zhan et al. (2016)).

Conclusions and suggestions for further research

Theoretical limitations and suggestions

As descriptive statistics shows, the research on contract payment/pricing and risk allocation is heavily under-theorized. While literature from OSCM field consistently applies theories, and in some cases so do PM publications, almost all ECM research lacks in this aspect. Absence of a theoretical lens, or its implicit/fragmented application limits theoretical contribution and value of the research. There is further room for application and elaboration of well-established agency theory, TCE, utilities theory, game theory. There could be also further suggestions in studying incentive contracts in particular with application of property rights theory (Selviaridis and Wynstra, 2015), or further application of real options theory in studying convertible or target cost contracts.

We also see some room for improvement in terms of rigor of wording the intended contribution and results. A clear explicit statement of research question and intended contribution in terms of exploration, theory building, testing or elaboration, and discussion of results connected to it would help in proper positioning the papers in the existing body of the research, and would help future authors to identify the filled and existing gaps in the knowledge base.

Empirical limitations and suggestions

While there have been attempts to answer many important questions in the topic of choosing the best contractor payment type, one (and probably the most important) question is still open: the role of, or the effect of the contract payment/pricing in the project results (that also can be understood quite broadly – in terms of cost, quality, schedule, but also safety, customer satisfaction, etc.). It is a question of high importance: if we do not understand which role the contract type plays in the project, we cannot ultimately properly evaluate and argue about its effectiveness. It is a very challenging problem, as many other factors except the contract type affect the project outcomes, and it is not possible to control for all of them. However, there is a need to continue searching for the answer, possibly in moderating of mediating relationships, continuing work of Rose and Manley (who attempted to find the effect of incentives in the project results) and Suprapto et al. (investigation of different contract types' influence on the project outcomes).

A lot of attention has been devoted to incentive contracts that are complex to design and manage, but at the same time have a unique potential to balance risk between the project parties (and thus overcome the problem of "extreme" risk allocation that both fixed price and cost

reimbursable contracts have). While incentive contracts seem to have been investigated quite well, there are still questions that are open for research: e.g., there is no investigation about design and effect of behavioral, or input, incentives that are applied in practice, sometimes in combination with such traditional ones as cost and/or schedule.

Among contract payment/pricing types, the convertible contract has received the least attention from scholars so far. It still needs to find its place in the range of contracts; we need to understand better its potential for balancing risk allocation between the contract parties and overall applicability. It may be less complex to design and implement than incentive contracts, but it may be able to link the risk allocation to the level of project risk and uncertainty. However, these are still open questions that await the investigation.

Risk-related literature is strongly focused on the problem of optimization of risk allocation, understood as overall minimization of the project risk. While numerous original models for optimal risk allocation have been created, there is limited information about their actual practical applicability and use; they need to be further tested in practice, as their ultimate goal is to offer a suitable tool for practitioners. We also lack information in general about the need (for more) of such models in practice. There is room for more studies about what various types of organizations (owners, contractors, consultants, etc.) actually do when they face the task to allocate project risks: what methods and tools they apply, and what is the actual work process they follow. These studies call for qualitative methods, in order to ensure deep understanding of the context and processes.

Numerous survey studies have investigated risk allocation preferences of different project participants. However, most publications are exploratory and do not attempt to identify any relations between/among variables and test theory. In addition, they have primarily studied PPPs; their findings are limited to the desired allocation of risk to either public or private project participants, but do not go to a more granular level. Finally, many surveys have developed original risk registers, but the fact that they differ makes comparison of these studies a challenging task. There is room for more theory testing, based on solid theoretical background. We also do not have sufficient understanding about risk allocation in the private construction (as generalizability of the studies focused on PPPs may be limited): what are the preferences of project participants, what factors enhance and hinder optimal risk allocation, etc.

Finally, we would like to point several more research opportunities that apply to both pricing/payment- and risk-related studies. First, all papers in our review are examples of "variance" research; as scientists, we still know little about the process of developing decisions about contractor payments and risk allocation; such questions call for longitudinal studies and especially process research. Second, the reviewed publications address the problem of payment and risk allocation on organizational or inter-organizational level; no studies that look inside the organizations, e.g. how different project functions (e.g. procurement, legal, project and risk management, etc.) view optimal risk allocation or contract types, or what are their roles in development of the contracting strategies. Third, while a construction project is a one-time undertaking, the same parties can work together in several projects (simultaneously or over time). How and if repeated interaction affects the choice and the process of risk allocation and contract payment type has not yet been investigated. Finally, we have noticed that many empirical studies turn to the infrastructure sector for the data collection. While infrastructure projects are complex and expensive, and give a lot of ground for thought and investigation, we suggest that the research diversifies into other types of construction, or attempts to compare construction sectors to understand their differences, similarities and potential generalizability of existing studies' results.

This working paper reports on the first part (contracting strategies) of our systematic literature review. While rich and varying literature has been uncovered, there is still need and room for future investigations. We also expect that our findings will be enriched (and potentially altered) after the completion of the second part of the study related to the project delivery approaches.

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Big data analytics in supply management: Creating business value from big data driven supply market intelligence

Salla Paajanen
VTT Technical Research Centre of Finland, Vuorimiehentie 3, Espoo, P.O. Box 1000, FI-02044 VTT, Finland, tel +358 40 150 4352, salla.paajanen@vtt.fi

Anna Aminoff
VTT Technical Research Centre of Finland, Vuorimiehentie 3, Espoo, P.O. Box 1000, FI-02044 VTT, Finland, tel +358 40 591 7979, anna.aminoff@vtt.fi

Abstract
Since companies increasingly leverage external resources, supply market intelligence (SMI) has become firms' key capability. This is challenging as supplier and supply market data derive from various sources. This study examines creating business value from applying big data analytics (BDA) in SMI. To achieve this objective, qualitative data is gathered from focus group discussions of 40 purchasing professionals and BDA experts, and semi-structured interviews of 22 purchasing professionals and BDA experts. The findings indicate that BDA can create competitive advantage through SMI by integrating external data into companies' context and providing value through actions, especially related to supply risk management.

Keywords: Big Data Analytics, Business Value, Supply Market Intelligence

Introduction

In today's complex and dynamic business environment, supply management researchers and practitioners are searching for new ways to increase supplier visibility (Li et al., 2017). Development of technologies legitimate the next level of maturity in procurement, which can be referred to as procurement (and supply management) 4.0. This progress stands for the digitalization and automation of the function within its company and supplier environment, in which the degree of integration and change in supplier relationships has an important role (Glas & Kleemann, 2016). Thus, special capabilities, such as big data analytics (BDA), are needed for the procurement function.

In procurement 4.0, companies need strategies for integrating established technologies available on the supply markets (Glas & Kleemann, 2016). Responsiveness to market change determines a firm's effectiveness, and effective incorporation of market knowledge reduces unexpected surprises, resulting in enhanced dynamic capability (Sher & Lee, 2004). In the context of procurement 4.0, this capability refers to supply management alignment, empowering the linking of internal and external parties (Handfield et al., 2015). The supply management alignment requires creation of supply market intelligence (SMI), which can be defined as "the ability to develop deep insights into key supplier market characteristics, including emerging technologies, price and cost trends, mergers and acquisitions (M&A), capacity requirements, quality and delivery performance, and other key supplier capabilities that form the basis for sound strategic sourcing" (Handfield et al., 2009, p. 103). Even though the importance of SMI is recognized as a central factor of supply management, BDA in the context of SMI is a topic that has been only rarely researched.

The scope of this study is BDA in SMI, focusing on the strategic importance of investing in insight-based decision-making and value co-creation. In order to study BDA in SMI, the paper answers the research question: *What is needed in order to achieve business value from big data-driven supply market intelligence?*
As the theoretical background of this study, existing literature focusing on BDA in supply management is reviewed. The research is conducted via qualitative methodology of different data collection methods. Empirical data is gathered from BDA experts and purchasing professionals using focus group discussions and semi-structured interviews. The findings and analysis of the results are presented in the form of four propositions, followed by conclusions and discussion.

Literature Review of Big Data Analytics in Supply Management
As the strategic importance of supply management has increased (Ahtonen & Virolainen, 2009), supply management professionals need to generate and disseminate large amounts of information, develop a shared knowledge of the information, and filter the shared understanding into potential value, as well as store and share valuable intelligence within the organization (Handfield et al., 2015). In the literature (Handfield et al., 2015; van Weele & van Raaij, 2014), the importance of supply management in combining internal stakeholder needs and suppliers' resources is recognized. Supply management professionals need to develop their ability to better contribute in supporting corporate improvement targets and creating organizational competitive advantage (Tchokogué et al., 2017).

Creating SMI for forming the sourcing strategies has an effect on many value adding business areas, such as product innovation, technology development, knowledge sharing, new process capability development and multi-tier supplier integration (Handfield et al., 2015). The ability to scan the business environment for breakthrough innovations and new product development is increasingly essential for the success of companies (Cousins et al., 2011). According to Song & Thieme (2009), supplier involvement in market intelligence gathering activities has a consistent, positive impact, especially on the success of incremental innovations across predesign and commercialization activities. In terms of radical innovations, building a knowledge base through internal knowledge sharing and market knowledge acquisition contributes to the knowledge management activities (Zhou & Li 2012). Relevant SMI consists of insights about suppliers of products and services, including their capabilities, past performance and strategic initiatives, in addition to information about technology, industry trends, networks, capacity, inventory levels, as well as transportation and storage options (Esper et al., 2010).

The acquisition and transfer of knowledge between suppliers and a focal company characterize a fundamental driver of innovation, allowing managing and discovering new solutions to technical and commercial challenges in the marketplace (Cousins et al., 2011). New technologies may need new supply markets for products and services that build, operate and maintain innovative technology (Knight et al., 2015). Supply management professionals need to ensure that essential supply market information is acquired, shared, interpreted and exploited in a manner that creates competitive advantage (Zsidisin et al., 2015). Big data technologies enable the decision makers to create real-time intelligence from high volumes, varieties and velocities of data (Gandomi & Murtaza, 2015). Big data can be defined as "high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation" (Gartner, 2017). Big data is a combination of qualitative and quantitative data that depicts, among others, internal and external databases, social media, and the Internet.

The key in applying BDA in supply management is to apply big data tools for business decisions through an iterative process driven by business issues (Fig. 1). Gathered data from the supply base and markets need to be filtered and analyzed in the context of a specific business issue to meet data requirements and fulfil defined criteria (Handfield et al., 2009). Through this manner, BDA can identify and qualify new suppliers, map probable reactions to business events and highlight new trends in the industry, in addition to facilitation in finding new markets (Markham et al., 2015).

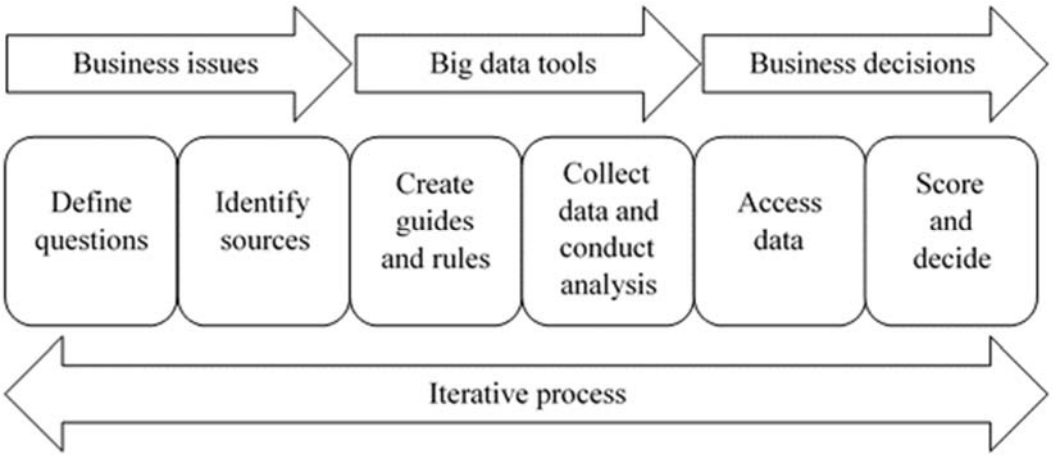

Figure 1. Process for big data-enabled decision-making (Markham et al., 2015).

Investments in information technology contribute the most when they enable dynamic collaboration capabilities in the supply chain (Fawcett et al., 2011). Regardless of the company's particular focus area, the fundamental objective is to accomplish alignment between the needs of the focal company and the capabilities of the suppliers from technical, cultural and behavioral perspectives (Petersen et al. 2005). BDA involves experimentation, which requires strong relationships and partnerships (Chen et al. 2012). Thus, it important to understand that BDA is a tool, not a direct answer (Markham et al. 2015).

Research Methods

Qualitative research is chosen as the methodology of this study due to the topic's novelty and continuous development, with only minor previous insights pertaining to the phenomenon under study. The choice of data collection methods was based on the type of objective of the study; to examine what is needed in order to achieve business value from BDA in supply management. Multiple methods of focus group discussions and semi-structured interviews were chosen in order to gather empirically relevant data from a large number of purchasing professionals and BDA experts.

Empirical data was gathered from two main areas: 1) focus group discussions of 40 purchasing professionals and BDA experts divided into six groups, and 2) 22 semi-structured interviews of seven BDA experts and 15 purchasing professionals from 11 companies (Table 1). Focus group discussions enable collective examination of the research topic through interactive discussion among the participants (Eriksson & Kovalainen, 2008). Additionally, semi-structured interviews allow gathering relevant and targeted information, via its customization to the study's research objectives (Lee & Lings, 2008).

Table 1. Overview of data collection

Objective	Method	Role of informants	Number of informants
To examine what is needed in order to achieve business value from big data-driven supply market intelligence	Focus group discussions	Purchasing professionals and BDA experts	40 (in six groups)
	Semi-structured interviews	Purchasing professionals and BDA experts	22 (15 purchasing professionals from 11 companies, 7 BDA experts)

Data analysis was conducted using NVivo qualitative data analysis software. The analysis was done via an inductive manner, due to the exploratory nature of the research. Following the characteristics of the inductive approach, the coding nodes were not predefined, but evolved during the coding process. The empirical data was analyzed from the point of view of answering the study objectives.

Triangulation of data is used to enhance validity of the study through collecting empirical data from different sources with various data collection methods. Triangulation refers to the use of different independent sources and data collection techniques within the study for certifying that the data is answering the objectives correctly (Lee & Lings, 2008). In this study, data triangulation is applied via sources of purchasing professionals and BDA experts. In addition, different views of analyzing the data by two researchers was applied.

The findings and analysis of the results are presented in the following chapter as aggregated answers of the respondents in tables, consisting of the unit of analysis, coded node and the reference. The amount of semi-structured interviews or focus groups in which the corresponding references were raised are presented in brackets after each topic.

Findings

In this chapter, findings from the empirical data of purchasing professionals and BDA experts are presented in the form of four main propositions. The first proposition states the importance of SMI in strategic supply management, the second proposition discusses the potential of BDA in creating systematic SMI, the third proposition states the significance of integrating internal and external data to create SMI, and the fourth proposition deliberates the realization of creating value from BDA. At the end of this chapter, a summary of BDA process for decision-making support in supply management is presented, followed by some of the main fundamentals for reaching the full potential of BDA in supply management, and future directions.

The focus group discussions provided insights into the strategic importance of SMI in supply management (Table 2). According to the purchasing professionals, SMI can facilitate negotiation of satisfactory price levels, conducting cost breakdown and accurate delivery forecasting, as well as minimizing unexpected and ambiguous price increases. When first segmenting the key suppliers, they can be further monitored through SMI in terms of growth, development, investments, strategic alignment and price fluctuations. Therefore, it is vital to have visibility into the company's spend costs and the supply market prior to negotiations.

The table below represents answers regarding the importance of SMI in the unit of analysis of strategic sourcing, as perceived from all the data collection methods. The amount of interviews / focus group discussions is presented in brackets after each reference.

Table 2. Importance of supply market intelligence in strategic sourcing

Unit of analysis	**Strategic sourcing**		
Coded node	**Spend analysis and opportunity assessment**	**Sourcing strategy**	**Category management**
Reference	- Category and supplier segmentation (10) - Market development / aftermarket opportunities (6) - Examination of the share of suppliers' revenue (3)	- Negotiating good contracts (12) - Defining strategic criteria and future vision (10) - Examining the focal company's attractiveness (5) - Supply base reduction (5)	- Categories based on components, technologies or suppliers (5) - Elimination of single sourcing (3) - Category strategy consists of regular scanning / value stream mapping (2)

Comprehensive SMI can facilitate ensuring better service with negotiations and contracts, especially when the focal company is a small buyer to the supplier and the purchase value is low. The attractiveness of the focal company is based on the share of revenue it provides to the supplier. The attractiveness can also increase by indicating growth potential for a particular project or product in contract negotiations. The purchasing professionals noted that required timespan for the supply market forecasts depends on the lead time and project-based orientation of the services and/or products in a particular category. Furthermore, start time of the negotiations has an impact on the negotiated prices depending on prevalent market prices. Thus, proposition 1 can be summarized in the following statement.

Proposition 1: Creating comprehensive SMI is important, especially in activities related to sourcing strategy such as establishing good contracts and achieving contract compliance with suppliers, based on knowledge and understanding of components' and products' market price levels and cost components.

In addition to sourcing and category strategies, SMI is needed for continuous risk and opportunity monitoring (Table 3). Supply risk management versus opportunity identification requires defining criteria for risks in the particular company and category. Different factors concerning supply risks, such as price compared to quality or amount of returns, can be evaluated via BDA.

Table 3. Creating continuous competitive advantage through supply management

Unit of analysis	Continuous improvement cycle of supply management	
Coded node	**Supply risk management**	**Driving innovation**
Reference	- Reliability of delivery and quality (6) - Alternative suppliers / materials (5) - Management of change / communication (5) - Financial situation of suppliers known (4) - Mapping country risks across borders (3) - Anticipating cost increases (3) - Proactive actions to new regulations (2) - Dependency / collaboration (2)	- Supplier technology roadmaps in collaboration with R&D and business (7) - Need derives from NPD processes (3) - Early supplier involvement (3) - Innovation execution / scouting disruptive innovations (3) - Utilizing partners' ecosystems (2) - Product upgrades require new requisites (2)

Supply risk management is different between categories as well as between strategic suppliers and tactic suppliers, and therefore requires different risk management platforms. Foremost, purchasing professionals considered it important to identify strategic suppliers, and form iterative risk evaluation, mitigation and contingency plans with them. Risk mitigation practices can consist of, for instance, recognizing new customer segments, technological developments and cooperation possibilities.

Further, visibility of emerging technologies and innovations, including digital transformation, was considered to be one of the most important aspects of SMI. Innovations need to provide new opportunities for value proposition synergies. Being able to absorb new technologies, the personnel need strategic and analytical competences. Driving innovation in the context of supply management includes conducting supplier technology roadmaps in collaboration with R&D and business. In addition, new product development processes require creating comprehensive SMI in order to find the best and most innovative suppliers. This leads to proposition 2 below.

Proposition 2: BDA has great potential in creating competitive advantage for companies in a continuous manner through actions related to supply risk management, such as availability of materials, and reliability of delivery and quality.

Even though there is additional hype associated with BDA, both the purchasing professionals and BDA experts considered BDA to have great potential in creating SMI. Based on the semi-structured interviews, some of the most important proactive actions that can be facilitated by BDA were perceived as forecasting customer needs and evaluating performance based on relevant measures, such as service level agreements or other quality measures. Furthermore, activating stakeholders and one's own business in development of strategies and processes in a proactive manner based on the analysis was considered important. According to the focus group discussions, ideal use of resources in SMI requires that everyone in the organization is involved in creating SMI and they must also understand the value of strategic decision-making.

In the semi-structured interviews of purchasing professionals, it was discovered that most of the interviewed companies gather external market data to support strategic decision-making. However, there is no systematic way to integrate the analyses into internal data and processes in-house. In many cases, external service providers and external sources such as consultant reports are utilized to create SMI. The need for applying an external solution provider for BDA depends on available resources and size of the company. Instead of focusing on the technical execution of the analysis, attention should be paid to integrating all necessary data into the analysis. *"In principle, any analyst can conduct the analysis, but incorporating the quiet information that is not written anywhere into the analytics delivers the real benefits. But it is not done a lot"* as identified by one of the BDA experts.
As perceived by the BDA experts, the source of value from BDA in supply management requires combining the company data and particular context with external data by utilizing analytical capabilities. One of the BDA experts stated from professional experience: *"Often companies start to resolve one issue, receiving some benefits, then resolving another issue and receiving new benefits, then conducting SMI and receiving some benefits, but really, the super value is in that you are able to do something in the intersection of the information clusters."*

There are various types of data from the supply markets, such as suppliers' financial performance and digital developments, which can contribute to creating deep insights in the suppliers' capabilities. One of the BDA experts stated: *"When it comes to big data, you can use any data, even that kind of data that would primarily seem irrelevant, but it can still make a difference."* Some of the most important data and information that is needed from the external supply markets allows examining and forecasting future market trends, innovations and technologies, suppliers' quality and delivery performance, existing suppliers' abilities, but also new suppliers and solutions, global price levels as well as product and service availability (Appendix 1). Once the size of the data increases, the data need to be stored on a cloud warehouse management system.

When integrating data from different sources to support decision-making, it is important to first gather and organize internal data from different databases and business units. After that, external data can be aggregated and integrated into the company's context. In order to integrate BDA into continuous decision-making support, internal data transfer and information retrieval first needs to be organized. One of the BDA experts advised as follows: *"This would be my best advice: don't think about the big thing and go into a project spending thousands or tens of thousands of euros and do the big thing, rather start small and do it in phases."* Therefore, proposition 3 can be stated as follows.

Proposition 3: Systematic and comprehensive SMI can be created by first organizing internal data, followed by integrating internal and external data from different sources and databases in order to implement BDA.

Based on the focus group discussions as well as the BDA interviews, existing suppliers' and different business units' data has to be first organized and integrated, in which communication and information sharing is important. Since the supply market consists of large amounts of data from different sources, it is not possible or even worthwhile to attempt to gather all feasible external data. Therefore, it is important to define what data is needed, why it is needed and how it is utilized to support the supply management processes. The BDA experts stressed that many companies still fail in aggregating internal data, such as purchase invoices, so integrating comprehensive external data to the unorganized internal data is a major challenge. Data aggregation of both internal and external data is a prerequisite for executing successful analysis.

According to the purchasing professionals, SMI can provide business value by building a system that gives alerts when actions need to be taken, such as a supplier has financial difficulties. As a solution, a BDA solution provider can code an external standardized signal that alerts and provides information when it encounters customized internal criteria related to changes in the supply base or market requiring actions. However, as one of the BDA experts specified*: "It is not enough that the system gives an alert, but it needs to justify why it was distributed and what should be done."* Instead, the alert should automatically be distributed to the correct person in charge of the particular field, and provide additional insights such as recommendations for further actions. In simple cases, issues can be automatically solved, since intelligent algorithms can learn from experience and past data input, enabling the proper handling of different situations.

Even though analytics and/or data aggregation could be outsourced to a solution provider, companies need internal capacities to absorb and distribute results of the analysis to support decision-making. If the extracted insights are not converted into intelligence across business units, value from the analysis will be unexploited. A gap may exist between analysts and business people, diminishing the potential value of BDA. As encapsulated by a BDA expert: *"A very critical part is that the one who is using the information understands what it is, and that is the biggest challenge."* Thus, proposition 4 can be summarized in the following statement.

Proposition 4: Value from BDA is realized only when the analysis is implemented into actions via more informed decision-making, derived from asking the right questions.

From the technical point of view, according to the BDA experts, BDA can create a competitive advantage for companies through SMI by integrating external data into a company's context via analytical capabilities and providing value through actions, especially related to supply risk management. In order to extract value from BDA, integrating internal and external data into a cloud warehouse management system is a prerequisite for transferring big data into the company's context. Different big data technologies can be used to conduct advanced analytics and interactive reporting for providing the end user a so-called *single point of truth user interface* for intelligent decision-making, which provides the analyses in one place in an understandable manner (Fig. 2).

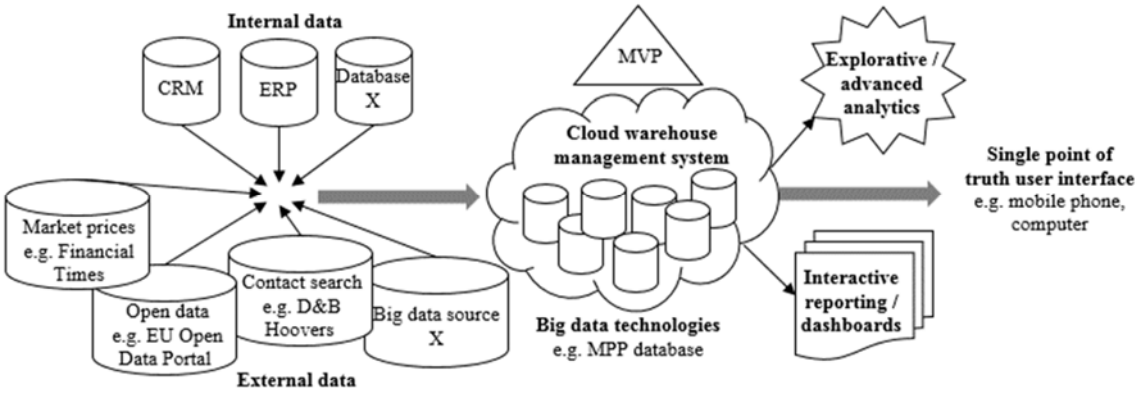

Figure 2. BDA process for decision-making support in supply management.

Ideally, the analyzed data can be accessed via interactive data exploration platforms and dashboards that enable zooming and mapping the needed knowledge. Most of the BDA service

providers execute a minimum viable product of the technical solution and leave room for developments according to customer preferences. A current technology innovation called a *massively parallel processing database* or other big data technologies can be used to provide real-time ad hoc analytics in addition to traditional reporting of the integrated data.

Some of the fundamentals for reaching this potential are that the analytics applications should be linked with the key performance indicators and aligned with strategy and business processes. Consequently, BDA implementation requires extensive background research and collaboration with the supply management professionals and analysts. The purchasing professionals do not need to conduct the technical analysis themselves, rather educate themselves about the analytical benefits in order to understand the analysis. Incorporating the analysis into actions enhances decision-making through improved forecasting.

Future directions of BDA in supply management were deliberated in the focus group discussions and semi-structured interviews. Firstly, in addition to integrating information within a company between departments and units, it will be integrated between different stakeholders. Integrating tasks with service providers will also increase, resulting in fading the interface between the focal company and suppliers. Suppliers can become more proactive, and the responsibilities for different areas can be shared when both parties have access to real-time information. Thus, easy-to-use and comprehensive information systems including global stakeholders will increase importance in gaining analytics visibility (e.g. spending and contract databases)

Conclusions and Discussion

In conclusion, it can be proposed that according to purchasing professionals, SMI is especially important in driving innovation by forming supplier technology roadmaps in collaboration with R&D and the overall business. The recognition that supply management can support the organizational competitive strategy (Tchokogué et al., 2017), is imperative for creating business value via SMI. Furthermore, SMI is vital for making good contracts with suppliers, consisting of negotiating desired terms. Knowledge of the predominant supply market conditions provides leverage in negotiating prices and deliveries. BDA can create competitive advantage for companies through SMI by integrating external data into company's context via analytical capabilities and providing value through actions, especially related to supply risk management.

Gaining visibility of market developments to influence the structure and evolution of the supply market in an attempt to ensure a sustainable and competitive supply market (Knight et al. 2015), can be facilitated by BDA. Analytics visibility through integrated information systems will become a requisite in global supplier relationships, in order to manage the external resources based on analyzed data. Understanding between business people and the analysts increases importance when implementing analysis into processes. Partnerships between supply management professionals and BDA experts are therefore vital in generating business value from big data.

In mature procurement 4.0, which is facilitated by development of technologies, companies need new capabilities to manage the suppliers' resources (Glas & Kleemann, 2016). Thus, companies need new strategies for integrating established technologies available on the supply markets. According to the empirical data, purchasing professionals and BDA experts consider BDA to have great potential in creating SMI. BDA enables the deployment of automated solutions. Routine functions and processes that are too easy or too complex to conduct by humans are automated ever more, leaving more time for strategic and meaningful tasks.

However, other digital technologies, such as blockchain technology, need to be considered in future research in order to study the potential ways of contributing to the overall competitive position of the focal firm (Foerstl et al., 2017). External solution providers can conduct analyses and assist in the technological implementation in collaboration with the focal company. Nevertheless, internal analytical mindset and understanding of the analyses are important for creating business value through new technologies.

Limitations of this study constitute of concentrating on the scope of supply management, and more specific area of SMI, instead of other theoretical perspectives, such as knowledge management. Future research could be conducted from the point of view of other theoretical lenses such as dynamic capabilities theory, as well as a wider range of technologies included in digitalization. This study is a first step for an important phase of unveiling the full potential of creating business value from applying BDA in SMI.

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Appendices

Appendix 1. Examples of data types in the context of SMI

Central information system	**Databases and registries**	**Supply markets**	**Social data**
Supplier / category spend costs	Total cost of ownership	Global price levels	Company's attractiveness
Contract information	Proprietary indices	Commodity MI	Corporate reputation
Working capital / savings	Suppliers' business impact	Quality and delivery	Corporate hierarchies
	Strategic alignment	Market (mega)trends	MyData
	Contract compliance	Availability and capacity	Social media
	Financial performance	Innovations / technologies	
	Suppliers' abilities	Key players and drivers	
	Consumer packed goods	New suppliers / solutions	
		Supply and demand	
		M&A and labor turnover	
		Rules and regulations	

The value of vendor rating for public institutions: the impact of supplier measurement systems on Italian public works performance

Abstract

In the private context, the vendor rating process represents an important lever for both strengthening the relationships with suppliers and the improvement their performance. When dealing with the public sectors, dynamics of this process presents substantial differences, mainly as the result of the stringent regulation which grounds on open competition, transparency and equality principles. Such characteristics make supplier performance measurement complicated, as they bind both the public institutions and the suppliers in a short – term view of the relationships, thus discouraging investment on this process. With this work, we aim to investigate the advantages that structuring the phases of vendor rating process (i.e. qualification, selection, ongoing assessment) may bring to institutions in terms of performance obtained from suppliers. In doing this, we consider as unit of analysis a specific type of contract – public works, and we adopt the perspective of the suppliers, testing this relationship on data about 205 public works projects executed in Italy in the last three years. Results show that, the higher the attention paid to the design of the qualification and ongoing assessment step, the better are the project performance (i.e. time, cost quality), while no significant benefit results from a structured selection procedure.

Theoretical background

Public Procurement is the process used by public sector organizations to obtain goods and services from a third party by mean of contract (e.g. Loader, 2015). Despite its traditional operational perception, this government function is today gaining even more and more relevance for public institutions at all levels, for two main reasons.

On one side, given that public spending dedicated to purchasing of goods and services impacts, on average, 29% of OECD countries' total government expenditure (OECD, 2015), this has become the first area where institutions look at when they are in search for efficiency and budget cut, in time of tight economic conditions. On the other, it is evident how, most of the goods and services are directly brought and used for citizens operations, thus affecting the level of service offered by national, regional and local government (Flynn and Davis, 2016; Loader, 2013; Pickernell et al., 2011; Uyarra and Flanagan, 2010).

These aspects are even more amplified if we consider a particular type of government procurement – the sub-contracting of public works. Public works are defined as the physical structures and facilities developed or acquired by public agencies to house governmental functions and provide water, waste disposal, power, transportation and similar services to facilitate the achievement of common social and economic objectives (Nash et al., 1977). The definition already gives a clear idea of the magnitude of spending that government invest in this category, up to 30% of Italian public procurement expenditure in 2016 (ANAC, 2017), and 27% on average at European level.

Public works represent a critical cornerstone for public procurement management, as they suffer from long durations (Gori et al., 2017) and a high degree of complexity from a financial, technical and legal point of view (Lenferink et al., 2013). Public works often relies on contracts that are subject to information asymmetries and contractual incompleteness, which often bring to renegotiations, cost

overruns or delays (e.g. Saussier and Tirole, 2015), and both cost and time escalations are likely to imply higher social costs and/or lower social benefits (Lewis and Bajari, 2011).

All these factors imply several problems when it comes to the work execution, by translating into performance, in terms of cost, time and quality (Chan and Chan, 2004), that are not optimal or in line with what expected (Wegelius-Lehtonen, 2001; Flyvbjerg et al., 2002; Ahadzi and Bowles, 2004; Cûlfik et al., 2014).

To explain the ex-post performance of public works, the previous literature has mostly looked at pre-execution stages, focusing either on the effectiveness of auction formats in limiting renegotiations or on the factors that prevent the contracting authority from accurately predicting the work's time schedule. Some others, instead, have addressed the shade relates to the influence that a number of relevant buyers' characteristics may play on procurement performance (e.g. Ambrosanio et al., 2016; Brown and Potoski, 2003; Guccio et al., 2014).

With the present paper, we want to add a new perspective on this, by considering in this problem the role played by performance management systems (PMS).

The government need of measuring performances management comes directly from the spread of the New Public Management (NPM) discipline (e.g. Verbeeten, 2008), promoting that the focus on the design of sound PMS represent a necessary condition to improve performance in public sector organizations (O'Flynn, 2007). Of course, this affects every government functions, including public procurement (Flynn and Davis, 2016).

Performance management for public procurement can be differentiated at two levels - internal (i.e. the execution of the public procurement process) and external (i.e. at a contract level, intending the results obtained from active suppliers), even though the maturity on institution on this is still under – developed, especially referring to the assessment at contract level (Patrucco et al., 2016).

If we look at private purchasing and supply management literature, the so called "vendor rating" process – defined as the set of metrics that, at different levels, are used to quantify both the efficiency and effectiveness of suppliers' actions (Caniato et al., 2014) - has received a lot of attention. The implementation of these systems, in fact, has demonstrated to be very effective when applied in a structured way, as they allow for a structured selection and evaluation of suppliers (Kannan and Tan, 2002) which, in turn, translates into cost savings (Ittner et al., 1999; Carter et al., 2010), improvement of business performance (Dumond, 1991; Kannan and Tan, 2006; Luzzini et al., 2014) and high-quality relationships (Carr and Pearson, 1999).

On the contrary, despite the large body of literature about public management PMS (e.g. Boland and Fowler, 2000), the topic of supplier evaluation seems not to be extensively addressed in both theory and practice (e.g. Ancarani, 2009). This is not so much surprising; public procurement is regulated by specific norms and regulation – promoting transparency, equality, fairness and open competition principles (Erridge and McIlroy, 2002; Raymond, 2008; Thai, 2009) – which don't make feasible establishment of long-term buyer-supplier relationships (Erridge and Greer, 2002) and, most importantly, don't allow inclusion of previous suppliers' performance into suppliers' tender (Sánchez Graells, 2015).

Although, it is evident that, as for the private sector, structured vendor rating systems represent the first driver for performance improvement, and attention on this variable cannot be neglected just for regulation motivations. These is even more critical for particular categories – like public works – where supplier improvement and good performance can be of benefits of both citizens and local

economy (Huang and Keskar, 2007). Hence, within the context of public procurement, they seem to be an interesting unit of analysis to spread awareness of vendor rating role and relevance for public administrations.

According to these premises, this work wants to study the application and consequences of supplier evaluation practices in the public context, using, as unit of analysis, procurement of public works projects.

Exploring vendor rating role in public procurement: a research framework

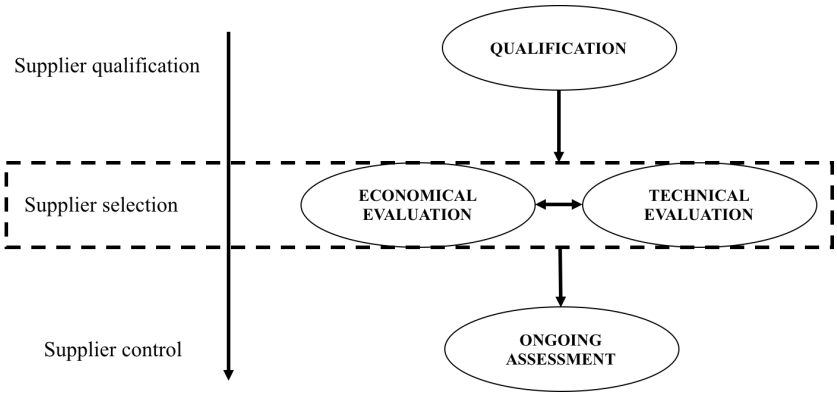
What emerges from the previous overview, is that, despite the relevance of performance measurement promoted by NPM for all government functions, this aspect is not so much diffused and addressed for what concern public procurement, for both regulation (there are some constrains limiting the degree of freedom of PMS design) and status (public procurement has been generally perceived as an administrative function) reasons (Rendon, 2008; Murray, 2009); this is even more true if we consider the contract level (i.e. supplier performance evaluation at contract level). However, these don't represent fair motivation, given the continuous improvement push that these systems can give, from which huge spending category (like public works) can benefit (Gori et al., 2017).
Sound supplier PMS, by enabling a structured selection and evaluation process (Kannan and Tan, 2002), generate advantages in terms of cost (Ittner et al., 1999; Carter et al., 2010), overall performance (Dumond, 1991; Kannan and Tan, 2006; Luzzini et al., 2014) and relationship (Carr and Pearson, 1999) improvement.
So, starting from this, the first aim of this research is trying to shed more light on the steps that public institutions should follow to design a structured supplier PMS, and the value they can get from this investment.

Since studies on public procurement in the public management field do not provide comprehensive contribution about on the design supplier PMS systems, in order to build our research framework, we start from the literature of the private context, trying to extract the design characteristics that better fit the public procurement process; from this, the model has been shaped according to the regulatory framework public procurement must respect.
Finally, the model is then specified for a particular procurement category – public works.

The supplier evaluation process in the public sector: research framework and motivations
As already discussed, in the private context, Caniato et al. (2014) identify three key choices in the designing a supplier PMS – strategic alignment, process configuration, execution; these three levels can be considered relevant also in the public sector, even though adapted to the public procurement environment.
In particular, given that the concept of "strategic alignment" can be hardly conceptualized for public authorities – where the "strategy" of government function is given and driven by broader policy objectives (Schapper et al., 2006), and that the decisions related of vendor rating execution (i.e. tools to support diffusion of the systems, control of measures and responsibilities) have similar implications that in the private context (e.g. Croom and Brandon-Jones, 2007), our attention is first on the process configuration choices, where the public procurement system seems to have higher impact.
First, we consider that, given the three typical phases of the measurement process – supplier qualification, supplier selection and supplier performance control, they are all relevant for the public domain, even though the public procurement regulation imposes some constraints at the different steps. So, if we want to suggest a reference framework for evaluating supplier performance, we still need to include and differentiate these three components, each one representing a different phase of measurement. Of course, the intensity of measurement in any of this stage will depend on both the

importance given by the procurement department to that specific stage, and the extent to which this concurs to strategic alignment and execution efforts (Flynn and Davis, 2016).
Considering the single step, the main conceptual difference between public and private context is in the case of supplier selection. In the case of public procurement, supplier selection can be managed according to two different options: lowest price or MEAT. Nevertheless, whatever the awarding criterion, the price always reveals to play an important role, being assigned a considerable weight (Roodhooft and Van den Abbeele, 2006).
This means that, according to the different situations, the selection criteria could include just economic aspects, or both economic and technical aspects, weighted differently.
For qualification and control, the regulation does not impose specific approach, neither a mandatory implementation. However, in line with the transparency principle, when present, qualification criteria and information gathered during contract execution (and results) need to evident and communicated to suppliers (Prahinski and Fan, 2007), thus indirect affecting the potential contract performance (Cûlfik et al., 2014; Gori et al., 2017). Finally, the discretional mechanisms based on the use of supplier performance in past relationships, which have proved to be very effective in the private context (Spagnolo, 2012) and in the U.S. public sector (Snider and Walkner, 2009), are not allowed to EU public institutions (Sánchez Graells, 2015). Past performance can although be included in an indirect way and only at supplier qualification level: at this step, contracting authorities may decide to ask the list of other authorities and industrial customers with which suppliers did business in previous years, thus being able to certify the overall performance of the vendor.

This discussion leads to the following framework (*Figure 1*):



As anticipated, in exploring the role that supplier PMS can have in the public context, we decide to use, as unit of analysis, a particular purchasing category – public works.
These types of projects are indeed characterised by some aspects making their execution worthy of attention such as high cost (Larson, 1995; Flyvbjerg et al., 2002; Wegelius-Lehtonen, 2001, Jacobson and Ok Choi, 2008), long durations (Ahadzi and Bowles, 2004; Chan and Chan, 2004; Cûlfik et al., 2014; Gori et al., 2017) and significant complexity (Takim and Akintoye, 2002; Lenferink et al., 2013). Furthermore, another important aspect highlighting the final performance of public works is the impact they have upon society (Lemer, 1999).
Thus, improving the performance of public works (in terms of cost, time and quality; Chan and Chan, 2004) is crucial interest for public administration at all levels, and a sound supplier qualification, selection and control process can definitely support this objective. Despite this, the regulatory framework characterizing public procurement seems to prevent the implementation of effective supplier PMS, so further analysis on the motivations that may force institutions to focus on this aspect can be considered value adding.

The supplier evaluation process in the public sector: hypothesis and research model

The previous discussion gives the possibility to state some more specific hypothesis on the role that the vendor rating process has for public institutions and, in particular, on the execution of public work projects.

First, it is reasonable to assume that a well-structured qualification may lead to the inclusion the "best suppliers" in the supply base. Some studies show how rigorous qualification requirements make the contracting authority capable to forecast whether the supplier is able to meet the specifications (Edler 2005) and to avoid misapplications of the procurement procedures (Jones, 2007). Special attention must be paid to this phase in the case of construction works, since a non-structured qualification leads to a wrong vendor selection, affecting the overall success of the work (Benaitiene and Banaitis, 2006). This leads to the formulation of the following hypothesis:

H1. A greater attention paid to the qualification stage may have a positive impact on work performance.

Then, we discuss that, regardless the selection criteria used, price always plays an important role in supplier selection (Roodhooft and Van den Abbeele, 2006). This is also true for public work, where the economic proposal evaluation is usually differentiated from the technical proposal evaluation (Gori et al., 2017). So, public institutions need to pay attention to the design of structured approaches for managing both types of evaluation, in order to arrive to the most suitable supplier choice.
On one side, selecting a supplier offering a reasonable bid from an economic point of view is crucial when dealing with expensive purchases as public works are (Huang and Keskar, 2007); on the other, identify the best economic offer is not enough, given the multi-dimensional complexity of public works (Lenferink et al., 2013), and also non-price attributes become important in the bids evaluation process. It is the combination of the two that may bring to the selection of the best suppliers, thus driving (indirectly) better work performance. This leads to the formulation of the following hypothesis:

H2. A greater attention paid to the economic evaluation of supplier proposal may have a positive impact on work performance.
H3. A greater attention paid to the technical evaluation of supplier proposal may have a positive impact on work performance.

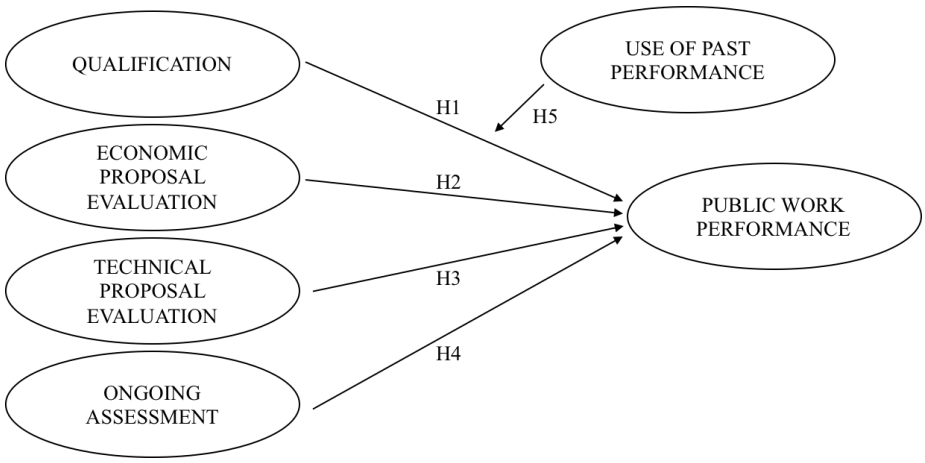
Differently to what happens for other purchasing categories, public works are characterised by long contract durations and activity execution (Ahadzi and Bowles, 2004; Lenferink et al., 2013), generating the need of measuring supplier performance during an extended period of time (Shenhar et al., 1997; Atkinson, 1999; Chan and Chan, 2004). Although measuring ongoing performance is complex and time-consuming, it is the point of starts for the identification of operational improvements, as well as for reducing project costs and duration (Wegelius-Lethonen, 2001).
This leads to the formulation of the following hypothesis:

H5. A greater attention paid to the measurement of ongoing supplier performance may have a positive impact on work performance.

Finally, even though with a limited incidence, we also include the role of supplier's past experience. As discussed, this role is weak if compared to the private sector, and it is allowed by the regulation only in the qualification stage. However, we cannot neglect that, when past experience and performance are included, the qualification stage can benefit of a more comprehensive view of suppliers. This leads to the formulation of the following hypothesis:

H5. The inclusion of past supplier performance in the qualification stage mediates the effect that intensity of qualification has on work performance.

The previous discussed hypothesis can be conceptualized in the following research model (*Figure 2*):



Research methodology: data collection and sample characteristics

Structure of the questionnaire

In order to test the model, we used data collected between September 2016 and March 2017 via online survey questionnaire, which was specifically designed for the purpose of this study. The ideal target respondent was construction company recently been involved in a public work contract.

The final version of the questionnaire uses, as a unit of analysis, a specific public work project (chosen by the respondent) executed within the last 3 years, and it is composed by 26 questions (most of them adopting a 1 – 4 Likert scale), divided into 4 sections: 1) Introduction (where general data about the company, the project and the public institution involved were collected); 2) Qualification (where information about the qualification criteria and approach used by the institution were collected); 3) Economical and technical proposal evaluation (where information about the selection criteria and approach used by the institution were collected); 4) Ongoing assessment (where information about the performance measured approach used by the institution during project execution were collected); 5) Results of the work (where information about overall project performance were collected)

Data collection

Our initial idea was to collect information using public administration as target respondents, but we realized that this type of data would hardly be collected because public managers initially addressed found difficult to identify the suitable person able to answer the questions or were not open to share this information for research purposes.

So, we decide to change the perspective, and consider, as target respondent, the suppliers.

To build our sample we start from the public available list of suppliers of the Italian public sector during the last 2 years. From the initial 83.000 company names on this list, we identify 6.013 references which actually were active construction companies in the recent past.

Before administering the survey, the questionnaire was first tested by selecting some of these companies (where contacts were already in place), to check the clarity of the questions.

Then, the questionnaire has been sent by mean of certified e-mail, asking the recipient to identify the most suitable person in the company to answer the questions. All the respondents are actually senior

and highly qualified project manager or construction manager, which were involved in first person in the project considerer as a unit of analysis. The final sample is composed of 205 responses (3,4% response rate).

The procedure of the study was a first way to control common method bias (Podsakoff et al., 2003). First, even though the research project was labelled as a comprehensive study to understand how public institutions manage the vendor rating process for public work projects, no reference to the model in *Figure 2* was provided, so that respondents' attention was not drawn to the relationships being targeted in this study. Moreover, questions were organized in an order that separated project characteristics from different vendor rating phases as well as from performance, to prevent respondents from developing their own theories about possible cause-effect relationships.
Finally, we immediately realized that a great bias in the data could have been asking the suppliers about the overall project performance (i.e. how much cost, quality and time of public work execution were under, over or in line with the contract target); however, once collected, the data about the projects were triangulated with information from Italian public administrations (public work reports over a certain threshold must be available to the public, upon justified request); in some cases, they were already present on the website; in others, follow – up calls and emails were necessary.

Sample descriptives

Table 1, 2 and 3 summarize characteristics of the respondents.

Geographical Area	Small	Medium	Large	Total
Northern Italy	22	56	14	92
Central Italy	6	39	6	51
Southern Italy	5	52	5	62
Total per area	**33**	**147**	**25**	**205**

UNSPSC	Meaning	Frequency	Freq. (%)
72102801	Renovation of buildings or landmarks or monuments	30	14,63
72102802	Restoration of buildings or landmarks or monuments	28	13,66
72131701	Highway or road paving or surfacing	28	13,66
72102902	Landscaping services	20	9,76
72103300	Infrastructure maintenance and repair services	13	6,34
Total answers		**205**	

Geographical Area	Regional	Local	Total
Northern Italy	12	92	**104**
Central Italy	3	54	**57**
Southern Italy	7	37	**44**
Total per area	**22**	**183**	**205**

Measures

The five constructs included in the model are summarized in *Table 4* and *Table 5*, in light of existent literature.

Table 4 summarizes the characteristics of the construct related to the vendor rating process, in light with the overall rationale of this process (Luzzini et al., 2014; Caniato et al., 2014).

Construct	Item	Sub-item	Variable	References
Qualification	Consider the qualification stage for the work you describe before. Please indicate to what extent the following aspects have been evaluated by the contracting authority (on a 1-4 scale)	Professional competence	Qualification 1	Shahadat (2003) Caldwell et al. (2005) Hackney et al. (2007) Raymond (2008)
		Financial capabilities	Qualification 2	
		Technical capabilities	Qualification 3	
	Consider the qualification stage for the work you describe before. Please evaluate the transparency shown by the contracting authority during the process (on a 1-4 scale)	-	Qualification 4	McCue and Gianakis (2001) Caldwell et al. (2012)
Economic Proposal Evaluation	Consider the selection stage for the work you describe before. Please indicate to what extent the following aspects have been evaluated by the contracting authority (on a 1-4 scale)	Economic proposal	Economic ev.1	Roodhooft and Van den Abbeele (2006) Huang and Keskar (2007)
	Consider the selection stage for the work you describe before. Please indicate the tendering tool used by the contracting authority	-	Economic ev.2	Croom and Brandon-Jones (2007) Gardenal (2009)
	Consider the selection stage for the work you describe before. Please evaluate the transparency shown by the contracting authority during the process (on a 1-4 scale)	-	Economic ev.3	Costa and Tavares, (2013) Spagnolo (2012) Costantino et al. (2011)
Technical Proposal Evaluation	Consider the selection stage for the work you describe before. Please indicate to what extent the following aspects have been evaluated by the contracting authority (on a 1-4 scale)	Project organization and duration	Technical ev.1	Chan and Chan (2004) Cûlfik et al. (2014) Gori et al. (2017)
		Quality of the work	Technical ev.2	
Ongoing Assessment	Consider the evaluation of performance during the execution of the work. Please indicate to what extent the following aspects have been evaluated by the contracting authority (on a 1-4 scale)	Financial capabilities	Ongoing 1	Takim and Akintoye, (2002) Chester and Hendrickson (2005) Shenhar et al. (1997) Wegelius-Lethonen (2001)
		Technical capabilities	Ongoing 2	
		Cost of the work	Ongoing 3	
		Schedule of the work	Ongoing 4	
		Quality of the work	Ongoing 5	
	Consider the evaluation of performance during the execution of the work. Please evaluate the frequency used by the contracting authority to communicate to your organization about the collected performance (on a 1-4 scale)	-	Ongoing 6	Prahinski and Fan (2007)

Table 5 shows instead the face validity for the dependent construct "Performance", which was assessed according to the cost, time and quality dimension (Chan and Chan, 2004). In order to obtain the performance indicators, starting from the data collected, we used the project variance approach for cost overruns, delays and activity scope (Flyvbjerg et al., 2002; Hsieh et al., 2004; Cûlfik et al.,

2014; Gori et al., 2017), by calculating the percentage of changes between what established at a contract level and what performed during the execution.

Variable	Item	Sub - item	Indicator	References
Cost	Consider the evaluation of performance during the execution of the work. Please indicate the cost (in €) established in the contract.	Cost.1	$\frac{Cost.2 - Cost.1}{Cost.1}$	Shenhar et al. (1997) Atkinson (1999) Wegelius-Lehtonen (2001) Chan and Chan (2004)
	Consider the evaluation of performance during the execution of the work. Please indicate the actual cost (in €) performed.	Cost.2		
Time	Consider the evaluation of performance during the execution of the work. Please indicate the execution time (in days) established in the contract.	Time.1	$\frac{Time.2 - Time.1}{Time.1}$	
	Consider the evaluation of performance during the execution of the work. Please indicate the actual execution time (in days) performed.	Time.2		
Quality	Consider the evaluation of performance during the execution of the work. Please indicate how much activities were executed in line with the project scope document	Qual.1		

According to these definitions, we try to operationalize the constructs on the data by running a factor analysis, with indictors on factors loading and Cronbach Alpha detailed in *Table 6*.

Variable/Factor	A	B	C	D	E
Qualification 1		0,970			
Qualification 2		0,877			
Qualification 3		0,939			
Qualification 4		0,965			
Economic ev. 1			0,679		
Economic ev. 2			0,901		
Economic ev. 3			0,871		
Technical ev. 1				0,858	
Technical ev. 2				0,823	
Ongoing 1	0,921				
Ongoing 2	0,971				
Ongoing 3	0,962				
Ongoing 4	0,961				
Ongoing 5	0,955				
Ongoing 6	0,882				
Cost					0,603
Time					0,918
Quality					0,638

Cronbach	*0,939*	*0,969*	*0,765*	*0,917*	*0,701*
Total variance explained = 72.322% Extraction Method: Principal Component Analysis, 5 factors imposed, Cases excluded pairwise. Rotation Method: Varimax with Kaiser Normalization. Factor loadings under .45 are not shown.					

As the value of Cronbach alpha are all higher than 0.7, we can consider the constructs acceptable.

5. Data analysis

In order to analyse data and test the model, we first performed some tests to assess common method bias. Given that we relied on a single respondent design, we controlled for common method bias in two ways: through the procedure of the study and through statistical control (Podsakoff et al., 2003). We already discuss the procedure of the study (*section 4.2*); to check common method bias from a statistical perspective, we performed the common latent factor technique (Podsakoff et al., 2003). With this analysis, we found that the common latent variable has a linear estimate of .6352. This value, when squared, indicates a variance of .404 which is below the threshold of .50. Overall, this ensures data analysis is not excessively affected by common method bias.
The presented hypotheses were tested using Covariance-based Structural Equation modelling (CB-SEM), which is a common method employed for this type of research, together with Partial Least Square Structural Equation modelling (PLS-SEM; e.g. Perols et al., 2013). As objective of our research is theory testing and confirmation, we decide to adopt CB-SEM, being PLS-SEM more suitable when the research objective is prediction and theory development (Hair et al., 2011).
The model was tested using the maximum likelihood (ML) estimation method (Arbuckle, 2009), as ML compared to other methods (like Generalized Least Squares and Weighted Least Squares) is able to provide more realistic indexes of overall fit and less biased parameter values for paths that overlap with the true model (Olsson et al., 2000). ML estimation assumes that the variables in the model are (conditionally) multivariate normal, which is true for our dataset according to the Doornik – Hansen test ($p > \chi^2 = 0.000$).

The hypothesized model was tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it is was consistent with the data. As long as the goodness-of-fit is adequate, the model argues for the plausibility of postulated relations among variables. The research model is analysed and interpreted sequentially in two stages: first the assessment of the reliability and validity of the measurement model and secondly the assessment of the structural model (Anderson and Gerbing, 1988; Hulland, 1999). Stata 14.0 was used to estimate both the measurement model and the structural model. The ML algorithm was used to obtain the paths, the loadings, the weights and the quality criteria.

Results

Measurement model

The measurement model fit indicators were found to be satisfactory (χ^2=202,823; χ^2/d.f.=1,673; RMSEA=.058; GFI=.907; AGFI=.869; IFI=.942; CFI=.980). The factors reliability, as measured by the Cronbach's alpha and Composite Reliability (Fornell and Larcker, 1981) was fully satisfactory (Nunnally, 1994). Additionally, convergent validity was assessed through significant loadings from all scale items on the hypothesized constructs, and through the Average Variance Extracted (AVE, Anderson and Gerbing 1988): AVE ranges between 52 and 78%.

Structural model

The postulated path model produced a sufficient fit to the data (χ^2=387,866; χ^2/d.f.=2.83; RMSEA=.095; GFI=.982; AGFI=.922; IFI=.926; CFI=.937). *Table 8* shows the results of the hypotheses testing. As we can see, standardized effects are positive and highly significant on work performance for Qualification and Ongoing Assessment influence (p-values < 0,05). By contrast, hypotheses H2 and H3 must be rejected.

Parameter estimates		**Std error**	**Z**	**p**
Qualification → Work performance	.94***	.023	3,997	.000
Economic proposal evaluation → Work performance	-.15 (ns)	.035	-0,417	.677
Technical proposal evaluation → Work performance	.022 (ns)	.028	0.802	.423
Ongoing assessment → Work performance	.121***	.038	3,215	.001
*Notes: *p<0.5; **p<0.01; ***p<0.001 (two tailed test)*				

We also test whether the use of reputational mechanisms based on supplier's past performance during qualification moderates the (statistical relevant) relationship between the work performance and the qualification itself.
The "use of past performance" has been measure in the questionnaire through a binary variable (1 if the institution has asked the supplier to provide references, 0 if not). *Table 9* show the results of the moderation analysis: the interaction hypothesis must be rejected because of a p-value equal to .7525, higher than the .05 threshold.

Model	**Coeff**	**Std error**	**t**	**p**
Constant	2.0046	.0502	39,9694	.000
Past performance	.2305	.06404	.3599	.7193
Qualification	.1179	.0234	5.0337	.000
Interaction	-.0551	.1746	-.3158	.7525

Discussion of results

The tested research model aims to study the influence that a structured vendor rating process may have on the performance obtained during the execution of a public work project.
Our results show that higher intensity in designing a sound qualification stage and structured measures for assessing supplier performance during the execution of the project has a positive impact in driving good project performance, while no evidence is found relating to the intensity of the economic and technical proposal evaluation. Also, past performance seems not to influence the relationship at the qualification stage (the only step, within the public vendor rating process, where they can be integrated).
The positive relationship between the design of a proper qualification for public work suppliers, and the performance obtained from those suppliers (once the contract has been activated) are in line with what theoretically affirmed by some scholars in the past. In the private sector, the importance of qualification has been extensively analyzed, demonstrating that this step, if properly executed, can have a positive impact upon the overall performance of the buying company (Carter et al., 1998; Sánchez-Rodríguez et al., 2005). This is not so different if we look at the public sector; qualification should be the first evaluation step also for public institution, independently from the procedure (open or restricted; Erridge and McIlroy, 2002; Bovis, 2005; Patrucco et al., 2017).
In this stage, the contracting authority excludes all those potential suppliers who do not meet the minimum requirements to carry out the supply (Wong et al., 2001; Arrowsmith, 2009); so, rigorous qualification requirements might enable a contracting authority to forecast whether potential supplier will be able to meet the required specifications successfully (e.g. Edler 2005).

Of course, qualification parameters in the public context are limited by the regulation (e.g. on-site visits are not allowed for a matter of transparency and equality; McCue and Gianakis, 2001), but this does not mean that this stage should be neglected. The EU Directives encourage supplier evaluation in terms of professional competences, financial capabilities and technical capabilities, despite this not being mandatory.
This is even more critical if we consider purchases with high cost relevance and long duration (like public works), since a non-structured qualification may lead to a wrong vendor selection, affecting the overall success of the contract (Benaitiene and Banaitis, 2006).
So, by demonstrating and empirical and positive relationship between the intensity of the qualification, and the performance obtained from the suppliers, we are able to push institution attention toward this (often) neglected step. Public administration should invest time and resources in designing a good qualification system, because this pays back in terms of work activities execution, brining better results in terms of cost, time and quality. From a broader perspective, a strong screening of the supply base, aligned to public procurement principles, assures that only the suitable suppliers will have access the selection phase.

The positive relationship between the ongoing assessment of suppliers performance during work execution and project performance, drives instead the attention toward another long – standing problem of the public sector: the contract approach to performance measurement. Public institutions tend to limit the definition (and control) of performance to what agreed at contract level; if this could be enough for simple purchases, this may become critical for complex ones, like public works, which are characterised by long durations and capital investment (Ahadzi and Bowles, 2004; Lenferink et al., 2013), thus generating the need of measuring work performance during the execution itself and using different metrics (Shenhar et al., 1997; Atkinson, 1999), in order to understand how suppliers are performing.
Supplier performance assessment should not be limited to verify that the supplier is accomplishing what has been established in the contract (normative approach), but it should be the point of start to collect information for identifying potential areas of improvement and understand how to improve future selection processes. Even though the formal inclusion of past performance is not allowed in public procedures, this does not mean that institutions should forget to monitor such performance (Erridge and Greer, 2002; Spagnolo, 2012; Sánchez Graells, 2015). Nevertheless, when information is gathered during the work's execution and the results are communicated to suppliers ongoing (Prahinski and Fan, 2007), there is a probability that the suppliers will try to improve or keep performance at good level, thus positively affected the final performance of the project (Cûlfik et al., 2014; Gori et al., 2017) and this aspect should not be underestimated, given the characteristics of public works, in terms of cost (Larson, 1995; Flyvbjerg et al., 2002), duration (Shenhar et al., 1997; Atkinson, 1999; Ahadzi and Bowles, 2004; Cûlfik et al., 2014; Gori et al., 2017), and complexity (Lenferink et al., 2013).

It is also reasonable that data don't show statistical relevance on the relationship between technical and economical evaluation and project performance.
For what concerns the hypothesis H2, which assumes an impact between the intensity of measurement in a usual selection process based on price criteria and the success of the work, it has been said so far that, supplier selection in the public sector is generally driven by price (Roodhooft and Van den Abbeele, 2006). The economic proposal evaluation is already a standard and a consolidated practice in the public procurement process, so higher intensity or a better structuring does not drive strong push on supplier performance. Similar consideration can be made on H3, as our data does not support the linkage between the intensity of public organisation in structuring the evaluation of technical aspects of supplier proposal during the selection and the result obtained with the work. It is thus clear that selecting suppliers by giving high relevance to what their bid proposes in terms of duration and

quality is not enough to understand the reasonability of such offers so as to prevent delays and low-quality executions.
Finally, some fundamental considerations can be made. Coming back to the steps of supplier evaluation in public procurement and their connection to the regulatory framework, it is possible to highlight how the qualification stage is carried out in some specific circumstances, depending on the awarding procedure used for the specific procurement process. The implementation of the Ongoing Assessment is instead left to the discretion of the public institution. By contrast, supplier selection must be carried out by resorting to open tendering procedures (Falagario et al., 2012; Patrucco, 2014). In such processes, the price is always assessed (Roodhooft and Van den Abbeele, 2006; Costantino et al., 2011; Patrucco, 2014) while the evaluation of the technical aspects is done when the awarding criterion used is the MEAT. In such a context, differently from what happens with Qualification and Ongoing Assessment, the supplier selection through tender is always carried out, regardless the characteristics of the specific project. Thus, a non-differential process among the different observations, is definetely not the driver of superior results.

The main findings and implications are summarized in *Table 10:*

Finding	**Implications**
Investing in designing a structured supplier qualification system and performance evaluation during the work execution pushes superior project work performance. Therefore, despite the binding regulation surrounding public procurement, the benefits provided by the vendor rating systems in the private sector can be transferred to the context of public works when the process focuses on these two phases.	1) Qualification is a supplier evaluation stage whose implementation is allowed independently from the awarding procedure. Public administrations should invest in designing their qualification stage, as this increase information collected on their suppliers 2) Ongoing performance assessment is an arbitrary phase of measurement. Public administrations should invest in designing their supplier ongoing performance assessment because it is the main lever to obtain superior performance, independently from what agree at contract level
The effort on evaluating supplier bids, from both economic and technical perspective, does not impact directly performance obtained from the suppliers	Supplier selection approaches are constrained and should be mandatory executed according to specific rules and circumstances. Public administrations should assure compliance to this regulation, but not invest additional resources on their design because, besides accomplishing public procurement principles, they are not a predictor of the work success.

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Big Data in Procurement - Literature Review and a Research Agenda

Ala Pazirandeh, Riikka Kaipia and Patrik Jonsson

* Department of Technology Management and Economics, Division of Supply and Operations Management, Chalmers University of Technology, 412 96 Göteborg, Sweden

(ala.pazirandeh@chalmers.se), (riikka.kaipia@aalto.fi) and (Patrik.jonsson@chalmers.se)

Abstract

More and more, academics and practitioners are urging organizations to adopt systems, techniques, or methods to use big data (BD) in their procurement practices to remain competitive. A major existing gap is the lack of understanding on how to generate value from the large amounts of varied data in procurement practices. Thus, with this study, we aim to increase the understanding of possible application areas of BD in procurement. By conducting a systematic literature review on the topic, we generate five procurement related research avenues for future studies, and thus develop a research agenda.

Keywords: Big data; procurement; predictive analysis

Introduction

Big data analytics (BDA) offers organizations powerful means to obtain value from the increasing amounts of data created internally and externally. Procurement, or in other words, the practices related to the inflow of supply including activities from strategizing for supply to the selection of suppliers, management of supplier relationships, and ordering and expedition, has claimed having a huge potential, but being lagging behind in benefiting from BDA (Schoenherr & Speier-Pero, 2015). In this area, knowledge generation has been suggested to happen by, e.g., using BDA to evaluate different supply risk scenarios (Schoenherr and Speier-Pero, 2015), improve data-driven projections on demand to plan purchases (Sanders, 2014), or aligning better internal and external supplier goals and processes to improve supply flows (Wang, et al. 2016). The purpose of this paper is to map current understanding about application areas of BDA in procurement through conducting a systematic literature review.

Big data (BD) is about large amounts of observational data that can support different decisions at different time frames (Bag, 2016). One existing issue is the understanding of how to utilize the data for business purposes. Stentoft et al. (2016) suggest that most companies don't yet know how to generate value from BD or a large amount of varied data. We aim to advance the field by studying how BDA literature has handled procurement, and how research could proceed to support procurement managers in their attempts to benefiting from BDA. Our research questions (RQ) are:

RQ1: How does extant research about BDA address and support procurement related decision-making?

RQ2: What are the future research opportunities for advancing knowledge generation through BDA in the area of procurement?

Method

For this study, we employed a systematic literature review approach to map the state of knowledge on BDA in procurement. We followed the process suggested by Rousseau et al. (2008), with the aim to answer our RQs. The following steps were taken to identify, extract and synthesize the findings.

Comprehensive identification of relevant research

Five stages of search and selection were performed to identify the relevant research. A keyword search was conducted in Google Scholar (in the article titles and keywords), and further validated by a search in Scopus and Web of Science (in the abstracts and keywords). No additional articles were found in the validating round. The keywords used for the search were originally based on an exploratory literature review using the phrase 'big data in procurement', and then through a discussion between all three authors a broader range of terms synonymous to big data and procurement were added. Two groups of keywords were defined, one indicating the definition of procurement (i.e. procurement, purchasing, supply, sourcing, supplier, negotiation), and those covering BD (i.e. big data, data analytics, data sciences, predictive analysis, data-based decision making, intelligence), and one keyword from both groups were required to appear in the articles (the logical operator 'AND' was used). The three authors jointly decided on the initial cleaning criteria and on the focus, which was to include all available articles that were accessible including journal, conference, and practitioner articles. One of the researchers went through the hits and based on these criteria, and deleting double hits, ended with 214 initial articles.

These articles were divided between the three authors so that at least 2 authors reviewed each paper. The inclusion and exclusion criteria were jointly decided by the three authors. Each of the researchers, color coded the articles according to red (excluded), yellow (uncertain), or green (included). By comparing the color codes, each pair of researchers disagreed or were uncertain about 20-25 articles (i.e. those coded as red-green, red-yellow, yellow-green, yellow-yellow), which they read again and held joint discussions until consensus was reached. The 76 articles identified in this round, were then divided between the authors for a more in-depth review by reading the whole article. Before data extraction, each article was again reviewed to ensure that it both had findings related to procurement or supply management, and that it was on BD. The excluded articles were then read by another author, and in case of difference of opinion they were discussed in the group until consensus was reached. Finally, articles mentioned in the literature reviews on BD in procurement were identified and reviewed according to our criteria (ended up in 3 additional papers). This comprehensive process resulted in 52 articles which were reviewed and coded.

Organizing and interpreting

For data extraction, following the Rousseau et al. (2008) suggestions, we first developed codes jointly among all authors, based on the exploratory round and previous literature. Codes for the procurement decisions were adapted from Van Weele (2010) strategic, tactical, and operational parts of the purchasing process (additional codes were added if procurement decisions not included in the framework were discussed in the papers). The codes were tested for four articles and adjusted accordingly. The articles were divided between the three authors for coding. To reduce mistakes and avoid omission of relevant material, the researchers met frequently during the coding process to discuss uncertainties and coding procedures. Next, the overall coding tables were combined, and reviewed by one of the researchers, and data was organized, probed, and sifted. Different themes

and topics of analysis were identified and divided between the authors (i.e. see next section of the paper). If necessary, data was again organized, probed, coded, aggregated, and cross-tabulated in different excel sheets for synthesis.

Synthesis

The themes, issues, and gaps surfaced in the process and based on the data were summarized in graphs and tables, and reviewed in the team by all authors. Inconsistencies (e.g. whether the paper was in fact discussing BD, or if the method was relevant) were also discussed in the team until consensus was reached. The results of this process are summarized in the next section of the paper.

Results

Over half of the articles were from academic journals, 32% of the articles were from conference proceedings (i.e. 17 articles), and 1 article was from a practitioner based journal of *Procurement Executive Insights*. From the 34 academic journal articles, two were from the *Journal of Computers & Operations Research*; all the other journals had one article each. From this list, there was one procurement based journal (*International Journal of Procurement Management*), three logistics and SCM journals (*International Journal of Logistics: Research and Application, International Journal of Physical Distribution and Logistics Management,* and *Journal of Business Logistics*), and an additional two operations management journals (i.e. *International Journal of Production Economics,* and *International Journal of Operations and Production Management*).

Development of the research throughout the years

As shown in Figure 1, the topic has gained attention only in the recent years with the first articles on the topic being published in 2008 and it is only gaining momentum from 2014 onwards (with 7, 6, 14, and 18 articles each year until 2017). The analysis about the focus areas of the articles (Figure 1), revealed that the articles with SCM as their main topic dominate the sample (29 articles/55%). Around one third of the articles (16 articles/30%) was discussing procurement as their main topic. Articles from other topics with findings related to the application of BDA in procurement were from supply chain (SC) risk management, supply market intelligence (SMI), new product development (NPD), and e-commerce (i.e. 3, 2, 1, and 1 articles, respectively). As visible in Figure 1, SCM and procurement are the two topics that have published articles on the application of BDA in procurement for the longest time (i.e. since 2008); SC risk management's first article on the topic was in 2013, SMI's in 2014, and NPD and e-commerce's in 2016.

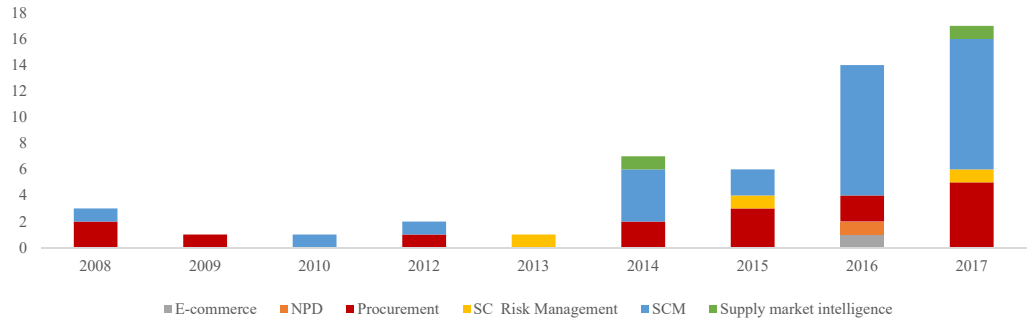

Figure 1 Number of articles with focus on different topics throughout the years (from 52 articles)

Methodology used in the articles

The majority of the articles, as shown in Figure 2, are either conceptual (i.e. 16 articles), or use modelling methods (i.e. 13 articles). This is followed by literature reviews and articles employing mixed methods (i.e. with 8 and 7 articles each). From the mixed method articles, 2 use focus groups and interviews, 2 use a combination of modelling and conceptual development, 1 uses modelling and a single case to illustrate its application, 1 uses modelling and empirical experiments for validation, and 2 use a combination of surveys and interviews, from which one also included a multiple case study. Additionally, there are 2 articles using a Delphi methodology and 2 using surveys. There is only one pure case study paper, and two articles using methods borrowed from other disciplines: sentiment analysis and native category approach. The practitioner based journal article, had not specified the method used behind its analysis.

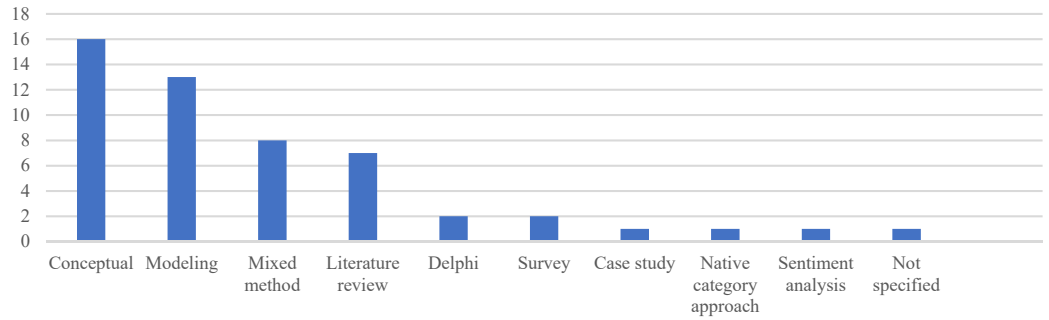

Figure 2 Distribution of articles based on method employed (from 52 articles)

From a total of 16 articles that used empirics to reach their conclusions, 46% used qualitative data, 27% used quantitative data, and another 28% used a mix of both quantitative and qualitative data. More details of these empirical papers are discussed under application avenues of BDA in procurement.

Scope of procurement related big data

The majority of the articles (i.e. 37) use the term BD, followed by other terms such as supplier intelligence (Jeeva and Dickie, 2012), supply market intelligence (Handfield, 2014), or word of mouth data (WOM) (Swain and Cao, 2017). Others refer to the concept using phrases such as '*huge amount of information regarding SC members*' (Rubio et al., 2016), or '*vast amount of data in various forms*' (Sahay and Ranjan, 2008), without using the actual term big data. While these articles used different characterization for BD, the majority referred to the 3Vs, describing Volume (beyond traditional data management capabilities), Variety (in different formats and form different sources) and Velocity (created in higher speed than ever) (e.g. Rozados and Tjahjono, 2014). Some of the articles had attempted to discuss BD in the procurement context, or what we will call procurement big data (PBD). Summarizing these discussions within the 3Vs, PBD was characterized to be in large volumes compared to traditional data, be of high variety in terms of sources (i.e. internal firm sources, external sources, private and public sources, open source, and the internet), as well as in terms formats (i.e. structured and unstructured, traditional and new, historical, etc.), and to be dynamic, and capture the real-time situation.

In terms of variety, a multitude of different sources and formats was suggested in the articles, reflecting on the seeable and unseeable potentials for PBD, which can be classified based on the internal and external source of data. From an external perspective, data from different social media sources, different data from or on the supply market (e.g. electronic market places, market indices,

market journals, etc.), data gathered from different media forms, and risk related data (such as indices, reports, critical commodity or supplier lists, weather report, natural disasters, etc.) were stressed the most. Among internal data types, spend data, purchasing data (e.g. product, ID, date, time, etc.), supplier data (e.g. qualification or performance profiles), and transactional data were the most highlighted.

Application avenues of BDA in procurement

The use of higher-level theories is almost absent in the articles in our sample. The only exception is the article by Liang et al. (2016) that applied social network theory to the context of procurement fraud detection. The article uses big data to quantify intimacy between buyers and suppliers and abnormal interactions, commodity prices and supplier credits.

We also summarized what procurement decisions (i.e. strategic, tactical, and operational) could benefit from BDA (Table 1). From the complete sample of 52 articles, supply risk management and supplier selection were the two procurement decisions that were mentioned the most. Strategic procurement decisions ranging from supply risk management and sourcing to sourcing innovation and category management in general had been mentioned more than others. On the other hand, operational decisions had received little attention.

Table 1 Suggested procurement decisions that can be supported by BDA

	Procurement decision	References	No
Strategic	Supply Risk Management	Liang et al. 2016; Connaughton and Sawchuk 2014; Dhurandhar et al. 2015; Fan et al. 2015; Handfield, 2014; He et al. 2014; Ivanov, 2017; Kache and Seuring, 2017; Lamba and Singh, 2017; Meriton and Graham, 2017; Moretto et al. 2017; Nguyena et al. 2017; Paajanen et al. 2017; Richey et al. 2016; Rubio et al. 2016; Sahay and Ranjan, 2008; Sanders, 2016; Schoenherr and Speier-Pero, 2015; Wang et al. 2016; Zage et al. 2013; Souza, 2014	21
	Supplier Relationship Management	Akter and Wamba, 2016; Barbosa et al. 2017; Connaughton and Sawchuk, 2014; Giannakis and Louis, 2016; Meriton and Graham, 2017; Paajanen et al. 2017; Richey et al. 2016; Rubio et al. 2016; Sahay and Ranjan, 2008; Mori et al. 2012; Souza, 2014	11
	Sourcing	Akter and Wamba, 2016; Ashayeri and Selen, 2008; Brinch et al. 2017; Connaughton and Sawchuk 2014; Giannakis and Louis, 2016; Ivanov, 2017; Lamba and Singh, 2017; Moretto et al. 2017; Sanders, 2016	9
	Buyer-supplier integration and coordination	Akter and Wamba, 2016; Giannakis and Louis, 2016; Kache and Seuring, 2017; Paajanen et al. 2017; Richey et al. 2016; Rubio et al. 2016; Sahay and Ranjan, 2008; Sanders, 2016; Yu et al. 2017	9
	Strategy alignment	Banerjee and Mishra, 2016; Brinch et al. 2017; Connaughton and Sawchuk, 2014; Jeeva and Dickie, 2012; Moretto et al. 2017; Sanders, 2016; Shaoling and Yan, 2008; Wang et al. 2016	8
	Spend management	Choi et al. 2016; Connaughton and Sawchuk, 2014; Handfield, 2014; Moretto et al. 2017; Nguyena et al. 2017; Surasvadi et al. 2017; Vaidyanathan and Sabbaghi, 2010	7
	Sourcing innovation (NPD and ESI)	Biswas and Sen, 2016; Kache and Seuring, 2017; Rubio et al. 2016; Rozados and Tjahjono, 2014	4
	Category Management / Segmentation	Sanders, 2016	1
	Sustainability	Kaur and Singh, 2017	1
Tactical	Supplier Selection	Biswas and Sen, 2016; Brinch et al. 2017; Deswal and Garg, 2015; Kaur and Singh, 2017; Lamba and Singh, 2016; Lamba and Singh, 2017; Lee et al. 2009; Matta and Tayal, 2017; Meriton and Graham, 2017; Moretto et al. 2017; Nguyena et al. 2017; Paajanen et al. 2017; Rozados and Tjahjono, 2014; Sanders, 2016; Shaoling and Yan, 2008; Vaidyanathan and Sabbaghi, 2010; Zrenka, 2019; Zage et al. 2013; Mori et al. 2012	19
	Negotiation	Biswas and Sen, 2016; Brinch et al. 2017; Lee et al. 2009; Moretto et al. 2017; Richey et al. 2016; Sanders, 2016; Schoenherr and Speier-Pero, 2015; Shaoling and Yan, 2008	8
	Improve transparency/visibility	Akter and Wamba, 2016; Giannakis and Louis, 2016; Meriton and Graham, 2017; Richey et al. 2016; Tan et al. 2016; Vaidyanathan and Sabbaghi, 2010; Yu et al. 2017	7
	Forecasting supply	Connaughton and Sawchuk, 2014; Giannakis and Louis, 2016; Lamba and Singh, 2017; Moretto et al. 2017; Richey et al. 2016	5
	Market knowledge	Lamba and Singh, 2017; Paajanen et al. 2017	2
	Contracting	Moretto et al. 2017, Schoenherr and Speier-Pero, 2015	2
Ops	Follow up and evaluation	Liang et al. 2016; Chircu et al. 2014; Lee et al. 2009; Matta and Tayal, 2017; Moretto et al. 2017; Paajanen et al. 2017; Shaoling and Yan, 2008; Vaidyanathan and Sabbaghi, 2010; Wang et al. 2016	9

Ordering	Kaur and Singh, 2017; Lamba and Singh, 2016; Richey et al. 2016	3
Monitoring and expedition	Chircu et al. 2014	1
Total number of articles		52

Looking closer at the finding of articles that used empirics, as listed in Table 2, we can classify them as those suggesting how companies can be more successful in application of PBD analytics, those describing the status of PBD in the industry, and those discussing the potential benefits that BDA can have for procurement decisions. In terms of success factors for PBD analytics, aside from the required PBD analyst skills (Bag, 2016; Handfield, 2014), it is suggested that organizations need to first internally integrate their information systems and then reach external integration before applying BDA, include suppliers in the decision making, know how or why they can use the BDA results, and, develop performance measurements for PBD analytics. The studies looking at the status of PBD in practice, suggest the area to be of growing importance (Sanders, 2016; Schoenherr and Speier-Pero, 2015), and that several companies are outsourcing parts or all of the analytical process to third parties (Sanders, 2016; Handfield, 2014). The articles on benefits of PBD either introduce an applicable model, map the opinion of experts/practitioners, or investigate the link between big data and procurement outcomes by regression path analysis (see Table 2 for details).

Table 2 Findings of the empirical articles

Nature of findings	Finding	Method and data	Reference
Success factors PBD application	For application of BDA, orgs first need internal integration, then external collaboration	2 focus groups with 75 purchasing professionals + 6 semi-structured interviews	Paajanen et al. 2017
	Supplier inclusions in decision making can assist BDA application	Survey of 481 responses	Banerjee and Mishra, 2016
	Skills of a Procurement BD analyst	Multi-criteria model based on evaluation of three candidates for a position by three decision makers based on eight skill sets	Bag, 2016
Success factors PBD application, & Status of PBD in practice	Sourcing is a growing area in terms of BDA; need to know how to use BDA results; Orgs are outsourcing BDA	52 open ended interviews + 102 survey responses + 4 cases	Sanders, 2016
	Orgs need to develop capabilities; Orgs are outsourcing BDA; need for performance measure for BDA	9 interviews and a survey of 89 companies	Handfield, 2014
Status of PBD in practice	45% of their sample had some sort of PBD initiative and another 18% had future plans to incorporate	Survey of 531 SCM experts (6.2% purchasing)	Schoenherr and Speier-Pero, 2015
Potential benefits of PBD	BDA can improve sourcing (supplier selection, evaluation, and price negotiation)	Modelling based on 1 manufacturer, 18 suppliers, 5 criteria	Deswal and Garg, 2015
	BDA can improve sourcing (supplier selection, evaluation, and price negotiation)	Delphi study with 24 individuals	Brinch et al. 2017
	BDA can improve strategic and tactical sourcing	4 focus groups with 15 procurement experts + non-specified number of interviews at the cases	Moretto et al. 2017
	BDA can improve procurement visibility and thus, sourcing	Modelling based on procurement transactions of one company between 2011 and 2014	Tan and Lee, 2015
	AHP and PCA both have shortcomings in handling BD for supplier selection	Survey from 235 suppliers on 21 criteria	Matta and Tayal, 2017
	BDA can improve sourcing (supplier selection, evaluation, and price negotiation), collaboration, visibility, and risk management	27 interviews in 27companies in 6 countries	Richey et al. 2016
	BDA can improve collaboration, visibility, and risk management	Delphi study with 20 individuals	Kache and Seuring, 2017
	Social media can improve collaboration, visibility, risk management, and supplier selection	Regression analysis of unstructured social media data from 600 companies	Swain and Cao, 2017

	BDA can improve procurement fraud detection	Modelling based on 100s of fraud cases and used in 65000+ vendors in 150 countries over 12 months	Dhurandhar et al. 2015
Total number of articles			**15**

Going deeper into the articles that suggest an actual application solution for BDA in procurement, we identify a number of common themes (see Table 3) with the two major ones being models to use BDA for supplier selection and better manage supply risk (e.g. detection of fraud, abnormalities, anomalies, unusual behavior). The other articles were grouped into those suggesting frameworks or models that can improve procurement visibility (i.e. visualization tools, RFID tracking, pattern identification), and frameworks or models related to how to use BDA to more generally support procurement decision making.

Among these suggested models and frameworks, less than a handful are based on empirical data and are worth highlighting. Tan and Lee (2015) introduce an analytical model to use BDA to improve decision making regarding internal demand aggregation and better coordinate procurement. They use an online analytical processing (OLAP) concept that includes drilling, pivoting, dicing and aggregating of data. Dhurandhar et al. (2015) suggest a model to identify procurement related fraud/risk using public and private sources of data ranging from transactional data, private sources (e.g. vendor master files, RFXs, risky vendor list, vendor bank account numbers, vendor-employee bank account matches, risky commodity list, global clip levels, company risk reports, financial indices, social networking data), to public data sources (e.g. government listed forbidden parties, country perception indices, tax haven locations, advance search engine searches, DUNS numbers). Finally, Mori et al. (2012), Deswal and Garg (2015) and Matta and Tayal (2017) apply analytical models (fuzzy logic, AHP, and PCA) to use BDA to select suppliers; all three articles either base their models on, or validate by, empirical data.

Table 3 Findings of the articles suggesting an application solution for BDA in procurement

Theme	Application solution	Method	Reference
Supplier selection	Shows application of AHP and PCA for handling BD for supplier selection	Model based on a survey from 235 suppliers on 21 criteria	Matta and Tayal, 2017
	A model using fuzzy logic approach and using MATLAB they show a supplier selection case	Model based on 1 manufacturer, 18 suppliers, 15 criteria	Deswal and Garg, 2015
	An AI model to match plausible partners	Validated by experiments on 30660 mans	Mori et al. 2012
	An analytical model using Fuzzy cognitive mapping to use BD for better sourcing of IT services	Modelling (No data)	Choi et al. 2016
	An analytical model to use BD for better and sustainable supplier selection and order allocation	Modelling (No data)	Kaur and Singh, 2017
Supply risk	A conceptual framework and simulation for using BDA for supply risk management	Conceptual	He et al. 2014
	Automated screening to identify deception instances	Modelling (No data)	Zage et al. 2013
	A robust tool to identify procurement related fraud/risk using public and private sources	Model based on 100s of fraud cases. Used on 65000+ vendors	Dhurandhar et al. 2015
	Procurement fraud detection system using data crawling in social networks, company profiles, and the internet	Modelling (No data)	Liang et al. 2016
Visibility	Application of data visualization for quick identification of issues, and access to e.g. supplier, model, part info.	Conceptual	Tan et al. 2016
	Cloud based system that tracks using RFID tags	Conceptual	Chircu et al. 2014
	An analytical system that uses open government budget requests and procurement records to identify spend patterns	Modelling (No data)	Surasvadi et al. 2017
Decision making support	A SCA architecture to use SC BD including supplier data to support decision making	Conceptual	Biswas and Sen, 2016
	An eProcurement system based on agent technology and OLAP to better co-ordination supply and demand	Modelling (No data)	Shaoling and Yan, 2008
	A framework for application of advanced analytics throughout the procurement process	Modelling (No data)	Lee et al. 2009

	An analytical model to use BD to improve decision making regarding internal demand aggregation and coordination	Model based on procurement transactions of one company between 2011 and 2014	Tan and Lee, 2015
	A simulation model using BD on capacity distributions to make dual versus single sourcing decisions	Modelling (No data)	Ivanov, 2017
Total number of articles			**17**

Discussion and further research

Our literature review contributes with a state-of-the-art description of the documented knowledge in the field of PBD. The findings add to our general understanding of how BDA can be utilized for procurement practice and paint a better picture of the current understanding of the matter. These findings also shed lights on possible and needed further research. We find that the number of publications on PBD is increasing but the total body of literature is still quite small. Big data's usefulness for procurement has mainly been studied as part of the wider SCM area, while there are very few papers with a specific focus on big data in procurement. These studies are too limited in number, data points, and findings, to make general conclusions and there is a need for more studies to develop such understandings. We identify five general areas of future research: conceptualizing and theorizing PBD, PBD capabilities, PBD application areas, PBD practices and trends, PBD interventions and design.

We found that the literature identifies many different data sources and formats of potential relevance for PBD. However, no conceptualization or categorization of data sources and data types has been presented from a procurement process perspective, and data sources and types have not been related to specific procurement applications. The review mainly shows that a wide spread of data sources and formats could be relevant for many different types of procurement decisions. Clearly defined and commonly used definitions and concepts are necessary for theoretical grounding and allowing for cumulative knowledge generation in the field. Consequently, future research should *establish common definitions and constructs of big data sources and formats of relevance for procurement decision making*.

Second, we only identified one paper on PBD capabilities, which is arguably an important topic in this field; i.e. the 'competence to provide business insights using data management, infrastructure and talent capacity to transform business into a competitive force' (Akter and Wamba, 2016). The lack of studies on capabilities is not surprising; it is hard to study without primary access to practices. Future research on *how capabilities moderate the PBD link to functional and firm level performance* is important for understanding the potential of PBD in strategy formation. Such studies should explore how management, technology and talent related big data capabilities contribute to achieving this. Such studies would require access to primary empirical data, but should also build on findings on BDA capability studies in other domains. Several companies are exploring and experimenting how they could benefit from BDA, so very soon we should have a much better understanding of what and how to benefit from BDA in procurement. No reviewed study uses an existing theoretical model on such a topic. In general, there is a weak theoretical underpinning among the reviewed studies. Future capability studies could, for example, build on resource-based view or dynamic capability models. So, a question for future research is *how existing operations management/organizational theories could help to better understand or predict application of BDA in the procurement area*.

Thirdly, Table 1 contributes with a preliminary conceptualization of application areas of PBD, and Tables 2 and 3 contribute with summaries of detailed findings on PBD application. The literature identifies many possible procurement application areas of BDA, with the majority of studies related

to supply risk management and supplier selection, and where future research should build on the existing findings. Supplier risk management is the most developed area, with at least three models showing the possibility of prescriptive and predictive models to use different data (structured and unstructured) from internal and external, and public and private source to better detect and thus manage disruptions (Zage et al. 2013; Dhurandhar et al. 2015; Liang et al. 2016). Future research should study the question w*hat are the topics and areas in supply risk management that BDA can better solve.* Supplier selection is another area, which had received attention by suggesting different BDA models for this area. However, there is still scarcity of studies, and *more studies are called for to test and validate a variety of different BDA models for supplier selection.* The PBD application topics have mainly been studied with modelling approaches using predictive and prescriptive analytics. The primary focus has not been the big data, but rather the analytics. In correspondence with the conclusions of Wang et al.'s (2016) review of big data in logistics and SCM, we identify very few studies exploring the use of descriptive analytics. Future studies on *using descriptive analytics in PBDA* would be relevant.

Fourthly, there are a handful of studies attempting to capture current practices and industry trends related to BDA in procurement. The findings range from the need to better define the reason for BDA in procurement, the identification of the potentials in BDA for procurement (without being specific), the interest in companies, or the need for integrated internal and external data systems, and that some companies have been outsourcing the analytics. None of the studies captures application possibilities or analyzes actual needs of the companies or industries. Most studies are using on conceptual, modelling and literature review methods. We identified one case study, the other empirical papers are based on focus groups, surveys, expert interviews, and Delphi studies. The lack of case study based papers is not surprising, as few PBD application practices exist to study. However, future studies on various aspects of PBD practices are needed in order to further the knowledge in the field. We see a future research need of *describing the level and patterns of implemented PBD applications in practice*, *understanding types and ways of using BDA in procurement*, and *perceptions and projections about future trends* of PBD. We found no study on *challenges, costs,* or *failures* of PBD. Such future studies would be very beneficial for developing practical and relevant knowledge about PBD.

Fifth, PBD, its application and analytics, is quite a new field of study with limited implementations in practice. Thus, there is a need for future studies *proposing how to use data sources and data types in procurement, and what outcome to expect*. Such studies could benefit from collaboration between researchers and practitioners, and the application of design science approaches where new interventions are developed, designs proposed and tested in practice.

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Sourcing trust is a multi-level concept - Insights from an automobile manufacturer

Ala Pazirandeh*

Chalmers University of Technology, Department of Supply and Operations Management, 412 96 Göteborg, Sweden, ala.pazirandeh@chalmer.se, +46737202832

Lisa Melander

Chalmers University of Technology, Department of Supply and Operations Management, 412 96 Göteborg, Sweden, Lisa.melander@chalmers.se, +46723752906

Carl Andersson

Lund University, Department of Industrial Engineering and Logistics management, Carl.LJ.Andersson@outlook.com

Johan Tharing

Lund University, Department of Industrial Engineering and Logistics management, jtharing@gmail.com

Abstract

With this study, we aim to increase our understanding of trust when selecting suppliers. Entering a relationship with a supplier for an extended period of time requires a certain level of trust on different facets (e.g. the interpersonal relationships, continuous supply, compatibilities, etc.). The question raised is how this trust is actually defined and used during sourcing, when the buyer decides on entering a relationship with a supplier. The phenomenon is studied in the automobile industry, which is experiencing a higher level of dependency on suppliers for sensitive and at times strategic components. A single case of a major Auto manufacturer is studied using 29 interviews. Our findings show that sourcing trust is a multi-leveled concept ranging from inter-personal to the network level.

Keywords: Supplier selection, Sourcing trust, Automobile industry

Introduction

The automotive industry is typically looked upon as being old and traditional, however, products and manufacturing processes are increasingly influenced and based on new technologies that are at times offered by consolidated supply markets (Kompalla et al., 2016). The electrification of vehicles is spanning from the removal of fossil fuels to integrating cars to both the infrastructure and other cars (Gao et al., 2016). Such changes lead to an increased use of software which is permeating the whole value chain. To be able to keep up with the rapid changes and technical improvements, an increased degree of collaboration between OEMs and their suppliers is required. Example of this can be seen in the partnerships in pursuit of developing autonomous cars. As a result, automakers, increasingly, need to rely on their suppliers (Henry, 2015; Holweg, 2008), being exposed to the supply risks including partner opportunism (Williamson, 1973); and thus, much care is required in the selection of suppliers.

The process of selecting suppliers is extensive and of great importance (Van Weele, 2014). There are a number of aspects to consider both commercially and technically, such as suppliers' operational capabilities, technological capabilities, organizational capabilities, quality, logistic consideration and delivery, and of course cost. In addition to traditional economic criteria, more contemporary requirements have surfaced including intangible attributes like honesty and reputation (Yadav and Sharma, 2016). Trust is one of the important drivers of the behavior-based attractiveness of strategic partners (Tanskanen and Aminoff, 2015). During initiation of a buyer-supplier relationship, trust, reputation, and mutual goals are considered to be more important than investments and commitment (Valtakoski, 2015; Dyer, 1996). However, purchasing managers do not typically consider these aspects, especially trust, in their decisions (Smeltzer, 1997).

The supplier selection process for auto manufacturers is affected by its supply chain structure where high dependencies between components, modules, and systems exist. This makes the process more complicated, hence it is of increased importance that the suppliers have competencies beyond development and production. This means, for example, competencies in module assemblies and the procurement of non-core components (Behncke et al., 2011). It is, actually, found that in the automotive industry a company's trustworthiness and its' market-share performance correlate (Dyer and Chu, 2011). Thus, it can be argued that suppliers need to be to some extent trusted or evaluated prior to selection to ensure they will remain trustworthy during the course of the relationship. Theoretically, trust in suppliers has been a recurrent subject of research during the last two decades (see e.g. Doney and Cannon, 1997; Villena et al., 2016; Zaheer et al., 1998; Agndal and Nilsson, 2008; Akrout, 2015; Dyer and Chu, 2011).

Studies are generally testing theoretically deduced hypotheses on what supplier trust is, the impact of contextual attributes, or how it is valued both positively (Valtakoski, 2015; Zaheer et al., 1998; Johnson and Grayson, 2005) and negatively (Villena et al., 2016) and mainly using survey data. Inter-organizational trust between existing partners has been studied the most in existing literature. While no direct link has been found between the duration of a relationship and amount of trust (Ganesan, 1994; Kumar et al., 1995), many contend that trust is developed as a result of relational aspect and during one (Dyer and Chu, 2011). However, trust can and arguably should develop prior to entering a relationship. Few studies have attempted to explain how this trust is understood or explained (Ekici and Sohi, 2000), calling for more exploratory studies to gain a deeper understanding of the topic. While some studies have suggested measures of trust in suppliers (see e.g. Seppänen et al., 2007), their findings are usually related to the ongoing relationships in a given context. Additionally, as these aspects often are investigated using quantitative methods and

thereby limited by the researcher's own understanding of the concept, a qualitative method can result in different conclusions regarding how trust for selecting suppliers is understood. We aim to contribute to these studies by studying how trust is understood and used to select a supplier partner (i.e. sourcing trust) by conducting in-depth interviews within an automobile manufacturer.
On the other hand, inter-organizational connections are dependent on the ties in between individuals, but also organizations and even the networks within which they operate (see e.g. Berends et al., 2011; Gulati and Sytch, 2008) and where trust is also suggested to manifest (Zaheer et al., 1998). We also add to this stream of literature by bringing empirical evidence (i.e. which has been scant) showing that sourcing trust manifests on four distinct levels of interpersonal, organizational, inter-organizational, and network (compared to previous studies discussing mainly inter-personal and inter-organizational levels).

Theory

Defining buyer-supplier trust

In business literature, trust has been defined quite varyingly and broadly discussing it in many different contexts, on different layers and levels, with no universal agreement on one definition, but, it is generally accepted that it is multidimensional and a critical factor in developing an inter-organizational relationship (Zaheer et al., 1998; Zhang et al., 2011). Yet, many scholars have conceptualized trust by the confidence (see e.g. Morgan and Hunt, 1994), and belief (see e.g. Kumar et al., 1995) in a partner's credibility and benevolence (see e.g. Doney and Cannon, 1997). For instance, Mayer et al. (1995) contend that benevolence together with ability and integrity capture the major portion of a partner's trustworthiness; ability relates to the partner firm's skills and competencies, while integrity relates to the trust in their use of a set of certain acceptable principles. In another example, Pirson and Malhotra (2011) suggest that in addition to integrity and benevolence, organizational trustworthiness is also based on the managerial and technical competence, identification and transparency. Sako (1992) distinguishes between three types of trust, contractual trust, competence trust and goodwill trust. Often in business relationships, however, credibility and benevolence are quite intertwined and impossible to operationally separate (Doney and Cannon, 1997; Zhang et al., 2011). In this study, we understand trust in a similar manner and as the buyer's confidence and belief in the credibility and goodwill of the potential supplier.

Credibility is based on a firm's belief that a vendor's capabilities and expertise can lead to the effective and reliable performance of the required tasks (Ganesan, 1994). Valtakoski (2015) studies the initiation of buyer-seller relationships and identifies that trust has a cognitive dimension, characterized by attributes representing credible demonstrations of success in implementing past solutions and the presence of formal education to demonstrate expertise related to the offerings. The findings from Stuart et al. (2012) suggest that trust in a supplier from a buyer's perspective is mainly defined by delivery reliability, quality conformance and general expectations of what constitutes "good supply".

In addition to credibility and goodwill/benevolence, we can also identify other attributes for buyer-supplier trust. The possibility to identify with another organization based on *matching goals*, interests, or values is one underlying attribute for trust. Existing of mutual goals and interests are the foundations required for trust to flourish on. Akrout (2015: 29) suggests that it is "paramount to pave a way for the emergence of trust" that companies create a fertile ground that encourages "mutual interest- seeking, needs and expectations management". In a similar manner, Hardin

(2002) claims that trust is mere the encapsulation of interest. And he argues that the trustee takes the trustor's interest into consideration only because they value the continuation of the relationship.

Valtakoski (2015) also identifies *willingness*, or interest in the relationship, such as the other firm's brand, sacrifices made to participate in meetings abroad, resources allocated, and the knowledge of local competition, as one dimension of trust when initiating a relationship (i.e. what he terms an affective dimension). Pirson and Malhotra (2011: 1090) suggest that the "understanding and internalization of the interests and intentions of the other party, based on shared values and commitment" is an important part of trust.
Transparency has also been mentioned as a prerequisite for trust (Agndal and Nilsson, 2008). Pirson and Malhotra (2011) define transparency as the degree to which an organization is willing to explain its decisions, openly share relevant information, or says if something goes wrong. For example, having an open-book policy and be transparent in the way they charge for a product or service can show trust and openness (Agndal and Nilsson, 2008). Sources influencing the assessments should be evaluated to ensure its validity (Doney and Cannon, 1997).

Finally, *Honesty*, defined as the fairness of partners, their motivation to lie, or their history or possibility of making false claims is also connected to trust. Honesty has been suggested by many authors including Jones et al. (2010), Whipple et al. (2013), Svensson (2001), and Swan et al. (1985). With this study, we aim to better understand which of these attributes, and potentially what other, manifest in the sourcing phase.

Multiple levels of inter-organizational trust

As organizations enter exchange relationships with others, they engage in different levels of connectedness. An organization's existing ties, past experiences and relationships, and expectations and position within a network creates opportunities for, and impacts its, future ties (Uzzi, 1997). But ties between organizations is also dependent on the connection between individuals across organizations (Berends et al., 2011; Gulati and Sytch, 2008). In addition to this inter-personal (between individuals) and inter-organization level (between organizations), Whipple et al. (2013) argue that trust in between organizations also manifest on two other levels of organizational (between individuals and an organization) and inter-organizational network-level (between one and many organizations). It is important for buyers to differ between the inter-organizational trust established with the seller organization and the interpersonal trust with the individuals representing that organization the interpersonal trust (Doney and Cannon, 1997).

One question arising is that at the pre-relationship phase (i.e. prior to selecting a supplier), on which of these levels does trust manifest. The first three levels can be conceptually argued for: the trust of the individual(s) at the buyer organization selecting the suppliers in the individual(s) at the selling side of the potential supplier; the trust of the individual(s) at the buyer organization selecting the suppliers in the potential supplier organization; and, the trust of the buyer organization in the supplier in the potential supplier organization. With this study, we explore to better understand how trust manifests on these levels and whether and how it shows itself on the network levels.

Svensson (2001) finds that trust is understood and used quite differently by the automakers towards their suppliers. It has been suggested that, at least in the automotive industry, interpersonal trust does not necessarily translate into inter-organizational trust. Instead, inter-organizational trust is highly based on processes on which the business is built upon, or "process- based trust" (Dyer and Chu, 2011). Impersonal processes and routines develop a solid context for exchange, which allows

individuals within the organization to come and go without affecting the organizational trust. Similarly, in their study on trust in buyer-supplier relationships in North America, Stuart et al. (2012) find that interpersonal communication between the buyer's and supplier's employees did not have any significant impact on trust. Managers saw trust as consistent with terms such as dependability and reliability; trust seemed to be synonymous with meeting expectations of the customer. Additionally, a trusting stance towards business partners seems to be somewhat connected to the company/business culture, since it appears that companies that highly trust their suppliers also trust their customers (Svensson, 2001). We aim to explore if existing supplier selection processes, in fact, reduce the significance of interpersonal trust and/or a strong trusting culture can impact the four levels.

Method

As recommended by authors such as Yin (2009) and Ellram (1996), studying a contemporary and dynamic phenomenon with limited previous knowledge, is best done in its real-life context. Since, the aim of this study was to answer questions about trust in terms of "how" it is understood by purchasers, we opted to study a single case, to gain in-depth knowledge. An established automaker in Sweden was selected as a representative of an organization facing the contemporary challenge to include trust as a parameter when selecting suppliers while having an established supplier selection process, and being a proponent of trust in business relationships. Additionally, as trust is a concept that requires a high level of communication with respondents to gain a deep level of understanding, semi-structured interviews were designed (as suggested by e.g. Easton, 2010).

Data were collected during Fall of 2015 and Spring of 2017. Data on the purchasing process, the organization, and the nature of the phenomenon was collected by one of the senior researchers by interviewing three persons on top of the purchasing department. After the 3 initial interviews, 26 other employees were interviewed, on the research questions, during a master thesis project by two of the authors (see Andersson and Tharing, 2017), and closely controlled by another of the authors acting as the supervisor during weekly meetings during Spring 2017. The interviewees were selected to cover the different aspects considered when assessing supplier trust; to represent a spread of scope of the performed tasks (i.e. operational to more strategic level); represent work with different types of suppliers in terms of size and commodity complexity; and, the inclusion of internal supplier selection stakeholders i.e. purchasing, Supplier Quality Management (SQM) and Research & Development (R&D). Selection of the supplier types was done together with the senior employee at the purchasing department of the company. Then, the operational buyers were identified and contacted through the corresponding responsible for each supplier category. Finally, responsible internal supplier-handler from the SQM and R&D were contacted as well (see Appendix).

Each interview lasted between 40-50 minutes. During the interviews, a set of questions were asked concerning the different aspects of trust in a supplier selection process. The questions were open-ended and designed to give the interviewee new perspectives to reflect on, by asking for concrete examples based on their experience. Prior to the interviews, each subject received an explanation of the research and the questions. All the interviews were recorded and transcribed.

Later, the raw data (transcripts) were translated and analyzed by the two senior authors in the Winter of 2017. Since every individual interview followed a slightly different route, each transcript was analyzed and the answers were sorted by the corresponding question. Then the organized answers were coded using an open coding technique (as defined by Yin, 2009). The answers of

each interviewee were assessed and grouped if showing similar traits, without the ambition of assigning any particular label to the group itself. The derived groups were assessed iteratively, where the number of repetitions varied between the groups. These were created based on either recurrent words or the nature of the content. Finally, the group was given suitable category name, where the traits for each category was compared with denominations from literature in order to potentially clarify the content with the use of common terminology. The processing of qualitative data concluded with a discussion regarding the potential gaps and similarities between the collected data and the theory identified during the literature review.

The case of supplier selection at an automobile manufacturer in Sweden

Supplier selection strategies, organization, and vision

Purchasing within the case company is a well-recognized and long-established function. The purchasing function is included in the production process and, from a development point of view, in top management of the business in general. For the case company supplier management, along with cost and quality are key factors. At the case company around 70 percent of the vehicle production costs come from external suppliers. Purchasing for the manufacturing of vehicles is done in the Car Purchasing unit and includes all the components, raw materials, and activities for the car itself. The annual turnover of direct materials for vehicle manufacturing in this company is about 76 BSEKs with around 200 employees. The company has approximately 500 active suppliers for direct materials on around 1200 active sites. Indirect purchasing, such as buying of facilities, services, and maintenance, is done at the Powertrain and Indirect Purchasing unit.

There is no strategy or directive on using the existing supplier base at the company. The aim is mainly to create the most efficient optimal supplier base for each individual purchase. The company has been working with many of their suppliers for decades and the top 10-15 suppliers have been working with the company for an average of 20 years. In such relationships, if no party (the supplier or the company) cancels the purchase order by the end of the year, they continue the business relationship for another year. From a technical perspective, it is often easier to work with old and established suppliers since the organizations know each other, their respective capabilities and their people. This might, however, result in missing out on important innovations. In the last two years, they have tried to broaden their supply market knowledge. In the opinion of the chairman of the Car Purchasing unit, the biggest barriers are mindsets; "*such market scanning takes much resource and people would rather stick to the old ways*".

The supplier selection process

The main purchasing process at the company is called the "sourcing process", where a supplier is nominated for business. This process is triggered by the company's decision on a vehicle development. Such developments require new suppliers for certain new components or ideas. In regard to the vehicle development "sourcing process", needs arise in the engineering department. They first prepare a sourcing plan, mapping needs, required activities, timeframe, and suppliers to invite. Then they perform what they call a "sourcing approach", in which the internal buyer or buyer team (i.e. the individual or team responsible for the purchase) presets their strategy to top management.

The executives and CEOs of suppliers regularly meet with the company's top managers; they present their research and advanced engineering and together discuss what the suppliers can add to the company. Supplier relationships management is also a question of how incoming offers are

handled and how they are used within existing processes and designs; "*it's one thing to talk at an executive level, it's another thing to actually make something of it*", one of the company's Executives argues. Another challenge is how to trust the right supplier; "*it's both about supplier management and also about selecting the right one*".

In the development of a new car, they often award suppliers contracts with a length of several years. The supplier then typically takes part in both the development and production of a component. Before making such a supplier selection, suppliers, and particularly new suppliers, are extensively reviewed. Three functions partake in the review: purchasing, SQM and R&D. For new suppliers, purchasing makes an overall review of the company, involving aspects such as financial data, ownership structure, and sustainability profile. A visit to the supplier is often made to interview management and a set of questions is guided by the use of an evaluation sheet. Purchasing also ensures that the supplier follows production purchasing global terms and conditions (PPGTC) and follow up cost estimates and cost breakdowns of products.

The company's SQM is responsible for reviewing production and quality issues at the supplier. A manufacturing site assessment (MSA) is made by visiting factories, conducting interviews, as well as investigating processes, quality systems and how defects and complaints are handled. In addition, a desktop review is made as well as a quality review. The R&D department reviews how well the supplier will manage technically to develop and produce a specific item. The supplier's technologies, technical capabilities, knowledge in-house and their systems are reviewed. The outcome of the reviews made by purchasing, SQM and R&D is collected and the suppliers that pass all the reviews go through to the next stage in the selection process. Following, purchasing conducts negotiations with the suppliers to get the best price. A "business case" is built and often the supplier with the best price is selected.

The four levels of trust when selecting suppliers

We found that a clear understanding or guideline for trust toward a potential supplier was missing at the organization; "*When dealing with a completely new supplier, you somehow have to assume that you can trust them*" (P11). This can be seen in the responses that discussed the role of individuals at their organization as a source of developing organizational trust or distrust: "*an individual can demolish your view of a supplier, just as an individual can trick you into thinking that the supplier is trustworthy*" (P8). The sensitivity and role of individual opinions in the lack of a clear guideline for development of trust can be seen in conflicting statements by the following two purchasers: "*I also check with my colleagues when we have a new supplier, to see what their views and opinions are about the supplier representative and the supplier organization*" (P2), in contrast to "*trust is very personal. I don't think it is something that can be put into a system or making it a policy. Trust is personal, it's emotions. It does not matter how good someone else thinks a supplier is if they are not good from my point of view*" (P10).

It is difficult to capture how individuals perceive trust as they often have very different definitions of what it is. While many consider trust an underlying factor to enter a relationship with another organization, some consider it a secondary, or even irrelevant: *"when I look at our part in SQM, then there is no personal trust, our documents (processes) ensures that we focus on other factors. … the personal trust towards one or two individuals does not matter. If I look at how purchasing is working, with their evaluation criteria they are very fact driven"* (S6). However, by digging deeper into the interviews we can see (as summarized in Table 1) that trust does, in fact, manifest at all four levels of interpersonal, organizational, inter-organizational, and network (as defined in

the previous literature by e.g. Whipple et al., 2013) during the selection of suppliers. In Table 1, we have summarized the coded results from our interviews in terms of how trust was understood (i.e. Manifestation) and based on information from what sources (i.e. Source), at these four levels, by the individuals in the purchasing (Px), SQM (Sx), and R&D (Rx) departments. We will further elaborate these findings in the following sections.

Interpersonal - The interpersonal level of trust relates to trust between individuals (Whipple et al., 2013), which in our study manifests in trust between individual employees at the case company and the individual supplier representatives; "*often it is the representatives from the supplier that determines how you view the supplier*" (P1). The interviewees pointed towards the importance a representative can make in the development of trust towards a supplier: "*the personal relationship is very important. If you meet good representatives from a company that creates some kind of trust towards that company*" (P11) or that "*a good KAM usually has a good organization and company behind him*" (P11). Our study shows a number of manifestations of interpersonal trust, such as credibility, honesty, willingness, knowledge and competence and transparency (see Table 1).

Table 1 Manifestation and information sources of trust when selecting suppliers on different levels

Level of trust	**Manifestation** **(How is trust understood?)**	**Source** **(What is the understanding based on?)**
Interpersonal (person-person)	**Credibility** [P1, P2, P3, P7, P8, P11, P13, P14, P15, P16, P18, S1, S2, S3, S4, S5, R1] (*top management, representatives, contacts, etc. on e.g. decision making*) **Honesty** [P12, P14, P15, P16, R1] (*e.g. intentions*) **Willingness** [P6, P12] (*e.g. understand the company's needs*) **Knowledge & competence** [P2, P7, P12, P13, P16, P18, S2, S4] (*e.g. their own offering, processes, technology, cost structures; professionality*) **Transparency** [P2, P10, P12] (*e.g. admitting mistakes and informing about problems and failures*)	Interview management [P14, S1] Negotiation [P18] Through working and interactions [P1, P7, P16] Providing the information that we need [P2, P9, P13, P16] Open dialogue [P7] Fact-based information [P2, P3, P13] Sales representative fights for the company's internally to get resources [P6] Being proactive [P1] Providing good examples [S1]
Organizational (person-org)	**Matching goals and interests** [P14, S6] **Stability** [P1, P8, P9, P14, S4] (*e.g. top management changing often, financial, ownership*) **Knowledge & competence** [P8,P14,P15,S2,S6,R1] (*e.g. commercial & technical, development & production capacity, quality systems, routines & standards, certifications*) **Performance** [P2,P3,P4,P8,P9,P14,P15,P18,S2, S6] (*e.g. quality, logistics, delivery reliability, turnover*) **Technology** [P4, P7, P9, P14] (*e.g. IT, production*) **Transparency** [P3, P9, P12, P14, P17, S3, S4, S6, S5, R1] (*e.g. information, organization systems, processes and structures*)	Understand our needs [P12] Discussing processes [S3] Financial data [P1, P8, P14, P15] Reports [S3, S5] How well do they answer our questions [P16] Similar previous work [R1] SEM, MSA, reviews, visits, audits [P1, P9, P14, P17, S2, S3, S5, S6] Repeated defects [S2] Common procedures across sites [S5] Verifications, testing, and simulations [R1] Accurate estimates [P3] Improvement possibilities [P2] Teach their product and technology [P9] Sharing possible challenges [S4] Not trying to cheat in order to get advantages to win the deal [P2, P14] Providing ideas and suggestions [P12] Colleagues views on the supplier [P2, P3]
Inter-organizational (org-org)	**Matching values** [P6, P8, P17, S5] (*Business culture, code of conduct*) **Collaborative/long-term orientation** [P1, P7, P9, P15, P16, P17, R1] **Transparency** [P12, S3, S6, R1]	Joint idea discussions [P12, R1] Working according to our expectations [P13] Keeping promises e.g. delivering a quota on time [P2, P5, P12, P17] Sharing patents [R1]

	(*e.g. communication channels, complaints, etc.*) **Experience** [P4] (*e.g. history, business today*)	
Network (org-network)	**Global presence** [P14] (*e.g. to deliver to other factories globally*) **Network of suppliers** [P15, P16, S5] **Network of customers** [P12, P15, P16, S4, S5, S6]	References from e.g. other OEMs [P14] Track record e.g. projects and customers (supplier of premium brands e.g. BMW, Porsche, etc.) [P12, P15, P16, S4, S5]

We find that credibility for the interpersonal dimension is related to top management, supplier representatives and whether the speaking partner has mandate to make decisions. Similar to Pirson and Malhotra (2011), we find that credibility in top management is important for trust: *"We meet with top management, if they are good then the rest of the organization usually also is good"* (S1) and *"A company's attitude and culture is formed by its management"* (S2). Since many automotive suppliers are bigger companies than the case company, it is somewhat difficult to affect these suppliers' management, hence making credibility in top management more important in the supplier selection phase. In addition, to build credibility, the supplier representative needs to have mandate to make decisions: *"You lose trust in a person when you sign a deal and then it turns out that the management said no to the deal"* (P8).

In addition, the daily contacts in form of sales representatives and key account managers are important for forming trust on an individual level. Credibility is also related to expertise (Ganesan, 1994), where a more experienced representative can be viewed as more credible: *"Sometimes trust is related to the sales representatives, what knowledge they have, how long they have been doing this and their attitude"* (P13) and *"Companies lose in having bad sales representatives I would say. Because we work so much together that we need to have a good relationship"* (P13).

Honesty, which is often discussed in the literature (see e.g. Jones et al., 2010; Whipple et al., 2013) is related to intentions, where supplier representatives does not have the intention to lie or deceive: "*I trust in the people I work with, that they have honest intentions"* (P14). Similar views are expressed: *"Trust is very important. I don't want to invite a supplier that I don't trust to final negotiations. I want to be sure that they can do what they promise"* (P18) which can be compare with a more critical view on supplier representatives: *"I have learned that all suppliers lie to me all the time"* (P11). Willingness on an individual level is manifested in the suppliers' willingness to understand the company's needs for a specific component or technology. Also, the supplier representatives need to be willing to fight internally to get resources for the company, who often is competing with larger automotive customers such as Volkswagen or Toyota: *"The sales representatives need to fight for us internally at the supplier"* (P6).

On an individual level, knowledge and competence are important attributes for trust. The supplier representative needs to have knowledge and competence about their own offerings, their manufacturing processes, their technology, understand cost structures as well as behaving professionally. Finally, transparency, which has been described as sharing information as well as communicating failures (Pirson and Malhotra, 2011) is manifested as transparency in admitting mistakes and informing about problems and failures. By knowing these issues, the company has the possibility to help the supplier solve its problems to ensure that failure does not repeat.

Organizational - The majority of the individuals in our study also discussed several aspects that contributed to their trust towards the organization (c.f. Whipple et al., 2013) which could be selected as a supplier; "*somehow it's the person you work with on a daily basis that creates trust. But it is important to separate trust in individuals and the company*" (P16) or "*I would say that*

80% is the company and 20% is the representative" (P11). One person from the SQM department noted that people move within the organization and thus in addition to "*working with individuals*" you will also be "*working with the company*" (S3). Trust in the organization was expressed to be about being able to trust that their systems, individuals, functions, and the entirety of the organization would be able to deliver; "*I need to know that a whole organization can deliver. Both during the project and during production*" (P18) or "*if you don't trust your counterpart then you need to control and double check everything*" (P16). As explained by several of the purchasers, such a comprehensive trust towards another organization would not just *simply* be gained: "*with extremely few exceptions, I don't trust a single supplier. They do what they can to rob us of money. It's as simple as that*" (P4) or that "*there are not that many suppliers that I trust completely*" (P6).

These aspects contributing to developed trust at an organizational level can be summarized as the matching of the organization in question's goals and interests with that of the company's, the organization's stability (in terms of their ownership, changing of their top management, and financial situation), knowledge and competence capacities on different functions (e.g. commercial & technical, development & production capacity, quality systems, routines & standards, certifications), performance (e.g. quality, logistics, delivery reliability, turnover), owned technology (e.g. IT or production technology), and organizational transparency (e.g. information, organization systems, processes and structures). The latter and former aspects are very much in line with what has been previously discussed in the literature (e.g. Hardin 2002 on matching goals and Pirson and Malhotra, 2011 on Transparency). It was, especially, noted how it is important for the case company to develop trust in the supplier's technical and developmental capabilities; "*generally, you need to have some trust in the supplier, not just commercially but also technically, that they are able to deliver according to R&D's requirements*" (P7).

The information on these aspects can be gathered from several different sources ranging from discussions, to reports, visits, audits, and different information the organization shares. One of the purchasers noted: "*with a new supplier, the focus is more on systems, structures and other things that are visible. Things that you can try to find out during a visit*" (P17). In this regard, it was noted how visits and audits can develop trust on the specific capacities and capabilities of that specific site, but perhaps "*not so much on another site*" (S5); or that in situations that a supplier had a joint venture, it would be necessary to assess it in relation to e.g. "*the communication alignment of the two*" (S6).

Inter-organizational **-** In our study, the inter-organizational dimension of trust was manifested in matching values, collaborative/long-term orientation, communication channels and experience. Matching values and interests includes aspects such as the business culture (Svensson, 2001) and professional code of conduct: *"Trust in relation to companies is that you can trust in a professional collaboration"* (P16) and *"We have to trust in the supplier that we are collaborating with, it's about trust in many areas. We need to understand each other and not have any hidden agendas between us"* (R1). Hence, it is important to have an understanding between the firms and that there exists organizational trustworthiness (Pirson and Malhotra, 2011). In addition, matching values includes that the suppliers are working according to the firm's expectations, keeping promises and delivering on time: *"That they do what they promise to do, according to our contract and on time"* (P5).

Collaborative and long-term orientation suggests a more relational view of the exchange, where the suppliers takes part in development efforts by joining in idea discussions, problem solving and other development activities (see e.g. Rosell et al., 2017; Melander and Lakemond, 2015). In such

a relationship, sharing information and ideas are vital: *"What are they open about? What are they not open about? Do we feel that we have gotten 100% fact from them?"* (P3). Although many of the company's relationships with suppliers are of a collaborative and long-term nature, there is still the need to be open towards new suppliers, both for accessing new technologies and for getting a better price: *"Long-term relationships are important, but we need to be open and try new suppliers"* (P9). Although it may be comfortable to rely on a known supplier, the need for new suppliers is understood in the firm, even if it may require more resources, time and money: *"Sometimes it's worth taking in a new supplier and investing money in helping them"* (P7).

Trust between organizations was also understood through communication channels, where daily oral communication as well as sharing of documents, drawings, test results and similar information is included. For a new supplier, building infrastructure for communication usually takes some time: *"For new suppliers we have a learning period, how we should communicate and contacts. From oral communication to drawings, models and simulations. The communication between the firms needs to be built on all levels"* (R1).

Finally, trust between organizations is manifested through experience, where the history of the supplier as well as previous collaborations are included. Suppliers need to show that they have succeeded in the past with technological implementations as well as commercial success (Valtakoski, 2015). For new suppliers, reviews of the organization are an important source of information: *"We do a thorough investigation of our suppliers before they are selected. We look at financial data and make supplier evaluations. We build knowledge about a supplier if it is a new supplier for us"* (P1). Experience is also expressed through the business that the supplier has today, where being an automotive supplier is important, as it shows that the supplier has experience from delivering to other high demanding customers. Although trust is viewed as important on an organizational level, it seems that price is a more determining factor in the supplier selection process: *"Trust is important. We don't pay more to get it, but if the choice is between two equal suppliers, then we choose the one that we trust the most"* (P5).

Network **-** The respondents also mentioned many aspects related to how trust on the supplier's network impacts their trust in the organization in question. Here, trust manifests in the global presence of the supplier organization, their network of suppliers and customers.

Potential issues with second-tier suppliers in e.g. delivery can directly impact the company. One of the purchasers mentioned how they experienced supply delays from one of their suppliers that was related to one of their sub-suppliers and not that easily solved (P16). To combat this, they try to audit and gather information on the supplier network of potential suppliers as well: "*we visit our suppliers and when there is a need we would like to check their suppliers as well (2nd tier). We need to have trust in that their suppliers can deliver and have the right quality. It's also about how they handle the material, their processes and inspections. There is an automotive standard, so most suppliers have the same standards and ways of working, but we want to make sure that it works*" (S5). Many of the respondents mentioned the importance of the customer network of the supplier all mentioning that the reputation of the customers increased their trust in the supplier, or that the "*trust in a supplier is much about its track-record … being an automotive supplier of premium brands such as BMW, Audi, Porsche etc.*" (P12).

Discussions and conclusions

Findings from this study, add to the ongoing conversation on buyer-supplier trust (see e.g. Akrout, 2015; Zaheer et al., 1998) by conceptualizing sourcing trust, or the buyer trust towards potential suppliers during the supplier selection phase. We extend the four levels of trust in inter-organizational relationships that are suggested in the previous research (e.g. in Whipple et al., 2013) by applying it to the supplier selection context and find that trust manifests in different ways at all four levels of inter-personal, organizational, inter-organizational, and network. Our findings suggest that the inter-personal level of trust is very much characterized as described in the buyer-supplier literature (see e.g. Pirson and Malhotra, 2011), but at the inter-organizational and network level new labels are required. This is not surprising as most previous literature has focused on the two former levels (see e.g. Pirson and Malhotra, 2011; Valtakoski, 2015; Doney and Cannon, 1997), and very few have discussed the latter two (see e.g. Whipple et al., 2013). Based on our findings, we argue that while the knowledge and competence (at interpersonal and organizational level), stability, performance, technology (all at the organizational level), experience (at the inter-organizational level), and global presence (at the network level), can all be categorized as part of credibility towards the organization (c.f. Ganesan's, 1994 definition), they need independent labels to better characterize trust in the supplier selection context.

At the network level, specifically, previous literature has defined it as the trust between multiple organizations (c.f. Whipple, et al. 2013), but there is very limited understanding of what it actually means and/or how trust really manifests at this level (Schorsch et al., 2017). Our findings present a clearer understanding of trust at this level, defining it as the trust of the buying organization towards the network of the potential supplier (i.e. the supplier's suppliers and customers); this trust can be related to the supplier's credibility both in terms of e.g. having reputable customers or suppliers, but also the credibility of the extended partners not to disrupt future supply. Further in-depth research is required on the inter-organizational and network level of trust in buyer-supplier relationships to paint a clearer picture of its characteristics.

This study further extends the work on buyer-supplier trust, such as the work by Sako (1992), which distinguishes between contractual trust, competence trust and goodwill trust. We find that elements from the three types of trust by Sako (1992) can be found in each of our four levels of trust. However, as we have studied the supplier selection phase, we find more elements related to competence trust and goodwill trust than to contractual trust. This is natural, as our study does not include contracts per se, but of course the firm's previous experience of the suppliers' capability of carrying out previous contractual agreements is one part of trust during the supplier selection phase.

Our findings show that contrary to suggestions by e.g. Svensson (2001) and Dyer and Chu (2011) - suggesting buyer-supplier trust in the automobile industry to be more inter-organizational (or process based) than inter-personal – that, in fact, trust is quite complex, manifests at all different levels, and that the levels impact each other (e.g. inter-personal trust impacts inter-organizational trust). Finally, the presence of the different functions in the buyer-supplier relationship, makes the totality of trust in this context quite complex, and thus, we recommend more studies to understand how, and if, trust is understood differently among the different functions interacting between the buyer and supplier, and to shed light on the potential implications of this.

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Appendix A – List of interviews

Table 1 - Number of interviews per department and task level

Department	Role	Code
Purchasing top management	Vice President of Purchasing	P01
	Director of Car Purchasing	P02
	Senior Purchasing Manager	P03
Purchasing	Purchasing manager (powertrain)	P1
	Senior buyer (commodity)	P2
	Purchasing manager	P3
	Senior buyer (commodity)	P4
	Commodity buyer (interior)	P5
	Purchasing manager (exterior)	P6
	Commodity buyer	P7
	Purchasing manager (forward sourcing)	P8
	Commodity buyer (interior)	P9
	Purchasing manager (closers)	P10
	Senior buyer (commodity)	P11
	Purchasing manager (interior)	P12
	Purchasing manager (interior)	P13
	Senior buyer (commodity)	P14
	Purchasing manager (electronics)	P15
	Purchasing manager (senior, interior)	P16
	Purchaser (interior)	P17
	Purchasing manager (interior)	P18
SQM	SQM manager (site)	S1
	SQM manager (senior site)	S2
	SQM manager (site)	S3
	SQM manager (senior site)	S4
	SQM manager (site)	S5
	SQM manager	S6
R&D	R&D Manager	R1

Appendix B Semi-structured interview guide

Finding	Question
How trust in supplier are understood in an automotive context	"What is your perspective on the word "trust" in the context of a supplier selection?" "How do you view the relationship between a company and its representatives?"
Which qualities that result in trust	"Which qualities/attributes do you think should be existent in order for a company to be considered trustworthy?" "How do you assess the trustworthiness of a supplier?"
What the effects of trust in suppliers are	"What is your perspective on the word "trust" in the context of supplier selection?" "How do you view the role of trust in comparison to other factors influencing the selection of a supplier?"

Adapting sourcing and supplier relationship management practices for discontinuous innovation through early purchasing involvement

Summary

The purpose of this paper is to investigate the research question of how Early Purchasing Involvement (EPI) in New Product Development (NPD) process can adapt existing sourcing and supplier relationship management practices for Discontinuous Innovations (DI). Based on an embedded case study approach, this paper explores four DI projects where the purchasing department was involved early in the NPD process. Data is gathered through interviewing managers and staff from the R&D, purchasing and marketing departments, and suppliers involved in the projects to capture their perceptions of early purchasing practices. The findings reveal interesting insights into how DI projects required a different approach to existing purchasing practices including a new role for the purchasing department and its relationship with other departments. Benefits and challenges associated with adapting existing purchasing practices through EPI are captured. Benefits include improvements in supplier research collaboration, the creation of recombinant innovations, and new supplier's technology advances for the focal company. Challenges include the promotion of new suppliers from distant technological domains. We derive propositions to guide further research into the role of EPI in DI. A framework of new and alternative sourcing and supplier relationship practices required for DI is also proposed.

Keywords: Early purchasing involvement, sourcing, supplier relationship and discontinuous innovation.

Competitive paper: 178

Introduction

Traditionally, discontinuous innovation has occurred throughout history such as the internet and mobile phone, but there is strong evidence that it is becoming increasingly more commonplace (Birkinshaw, 2007; Kortmann, 2014). For example, although smartphones incorporated existing digital camera technology, adapting this to mobile telephones, they were not responsible for developing new camera technology, but did profoundly alter the ways users used and bought photographic equipment. In 2017, Nestlé and Samsung announced a research collaboration to explore the potential of nutrition science and digital sensor technologies to provide new insights into healthy living (see nestle.com/media/news).

Although there is a body of research regarding purchasing involvement in New Product Development (NPD), a research gap exists in purchasing's role when companies embark on NPD under discontinuous innovation (DI) conditions. Managing DI from the standpoint of an organization requires new or at least significantly adapted approaches to their effective management (Bessant et al., 2010; Durisin & Todorova, 2012; Phillips et al. 2006). More specifically, previous research shows that practices that work well in the context of incremental innovation do not work in the context of DI (Bessant et al., 2010). Similar to Durisin and Todorova (2012) and, Kishna, Negro, Alkemade and Hekkert (2017), the term "discontinuous innovation" refers here not only to new product technology but extends also the exploration of new markets.

Applying the new regulations of the Energy Performance of Buildings Directive (EPBD) adopted in 2002 by the European Commission which imposes limiting the use of electricity has pushed HVAC companies to follow the development of renewable energies. It is in this context that the company we studied, which we call Anémos for reasons of confidentiality, has sought

to approach new renewable energy suppliers to develop its first DI project. Although the project seems to be controlled by the Anémos project team, issues related to the collaboration of new suppliers have emerged. In the period following this first project, Anémos decided to improve its supplier relationship and technology sourcing practices. Some of these improvements were related to involving the purchasing department at the early stages of NPD process.

Based on an embedded case study approach, we attempt to identify exploration practices such as sourcing for supplier ideas from unfamiliar domains (Phillips et al. 2006; Subramanian & Soh, 2017); scanning new technology (Rothaermel & Alexandre, 2009; Rohrbeck, 2010); and supplier "dalliances" relationships (Phillips et al. 2006) developed by the purchasing department early in the NPD for DI context. Two research questions are addressed: 1) how can purchasing (departments) involved early in NPD adapt existing sourcing practices for DI projects? 2) How can purchasing (departments) adapt existing supplier relationship practices for DI projects?

Our paper is organized as follows. After a literature review on discontinuous innovation and purchasing involvement in NPD, we present four case studies to illustrate how the purchasing department of Anémos pursues creative and alternative sourcing and supplier relationship practices in an attempt to respond actively to a DI environment. Then, we discuss our cross-case analysis and delineate further research by providing propositions. While four case studies may not be sufficient to construct far-reaching conclusions, our findings point to a need for a fresh look at the role of Early Purchasing Involvement (EPI) in DI. Furthermore, a framework of sourcing and supplier relationship practices in NPD under DI conditions is proposed.

Literature review on purchasing involvement in discontinuous innovation

Wynstra et al. (2003) argued that studies on supplier involvement in NPD need to be extended to purchasing involvement. The difference between purchasing involvement and supplier involvement in NPD is that supplier involvement does not focus on the function responsible whereas purchasing involvement specifically focuses on the purchasing's function role and responsibility on the collection and dissemination of information before or in parallel to the involvement of suppliers. According to Handfield et al. (1999), purchasing play an increasingly important role in involving suppliers in NPD as the level of knowledge regarding supplier capabilities is a critical success factor. Petersen et al. (2003) argue that supplier integration should require a detailed formal evaluation and selection of potential suppliers prior to consideration for involvement. In this case, McDermott and Handfield (2000) found that project managers must involve purchasing personnel early in the NPD process to help identifying potential suppliers with a demonstrated record that offer technological solutions to meet market needs.

An early contribution to research on early purchasing involvement in NPD under DI conditions was made by Burt and Soukup (1985), who identified six points in the design process at which purchasing should provide information and advice to engineering. These authors found that purchasing can act as a facilitator between NPD projects and suppliers' capabilities –especially when the product incorporates state of the art technology or combines technologies that have not been used together in the past. Under these conditions, purchasing can provide information about the costs, performance, availability, quality and reliability of various components. R&D or engineering teams would not normally have such information, which is necessary to avoid supply problems in the NPD process.

Appendix A presents an overview of literature on supplier involvement and purchasing's role in NPD under DI conditions. It includes information on study (authors and year), NPD under

DI conditions which entails technological change or "really new innovations" i.e. those requiring market discontinuities or technology discontinuities (according to Garcia and Calantone, 2012), method, focus, purchasing's role, findings and journal. The overview of literature shows that managing sourcing and supplier relationship in NPD under DI conditions becomes increasingly central to suggesting Early Purchasing Involvement (EPI). However, and similar to Johnsen's (2009) literature review, contradictory findings have been also noted regarding the adequate supplier relationship and the organization of purchasing to balance exploration / exploitation technology sourcing.

Technology sourcing or scanning methods

Anderson and Tushman (1990) identified that organizations should be able to combine technological capabilities with the ability to shape inter-organizational networks as technology cycles unfold in the course of their daily activities. Thereafter, Lambe and Spekman (1997) and Macher and Richman (2004) confirm that accessing external sources of information becomes more important the greater the time constraints; thus, successful firms in innovation-intensive industries are likely to institute organizational change or to promptly acquire technology knowledge from external sources of information.

Rothaermel and Alexandre (2009) suggest that technology knowledge searches can be either known or new to the organization based on the degree of uncertainty facing a firm in an innovation project. Thus, the firm's overall technology sourcing strategy might consist of simultaneously pursuing exploration by sourcing new technology and exploitation by sourcing known technology. In pursuing exploration, Rohrbeck (2010) argues that sourcing in DI requires technology scouting, which is a systematic approach by companies assigning part of their staff to gather information in the field of sciences and technology. Neither study, however, mentions how this affects purchasing managers or purchasing professionals.

Based on consortium benchmarking of six firms, Schiele (2010) explores the question of how to organize the purchasing department so that it can take a leading role in the sourcing of new technologies. He found that most of the firms had devised a separation into advanced sourcing and life-cycle sourcing. While an advanced sourcing took the lead for sourcing during the NPD process, a life-cycle sourcing took over once a product had entered production. His exploratory work, however did not investigate the implications of NPD under DI, although he suggests that some methods, such as purchasing scouts dedicated to scanning the supply market for new and unknown components, seem to be particularly relevant for this type of innovation.

Supplier alliances or "dalliances"

Supplier alliances have been found to be an important source of innovation to performance external technological knowledge into the process of innovation (Lambe & Spekman, 1997; Luzzini et al., 2015). Moreover, open communication with suppliers to understand their technology becomes more important in the presence of conditions of technology uncertainty (Ragatz et al., 2002). One explanation is that sourcing new technology from suppliers under DI is not sufficient; new technology also needs to be assimilated or internalized into the organization throughout supplier relational mechanisms (Knoppen et al., 2011; Melander & Lakemond, 2014). Another explanation is that alliance routines can improve mutual understanding and relative absorptive capacity with former suppliers, which is helpful in bridging diverse ideas across technological and organizational boundaries (Subramanian & Soh, 2017)

Bessant et al. (2005) argue that DI changes the "rules of the game" in managing supplier relationships, creating the need to look in strange "dark" areas and develop relationships with organizations from unfamiliar zones. Similarly, Phillips et al. (2006) propose that innovating firms seek to develop short-term "dalliances" with suppliers located on the periphery or even outside the firm's usual perceived supply chain boundary. Based on Phillips' et al. (2006) work, Noke et al. (2008) studied one supplier's strategic dalliance relationship in the oil and gas industry. They found that the strategic dalliance relationship was an effective enabler for DI projects by providing unlocking resources and novel information. In their study, a strategic "dalliance" was defined as a non-committal relationship that companies "dip in and out of" while simultaneously maintaining longer-term strategic partnerships with other suppliers.

Recently, Subramanian and Soh (2017) have demonstrated that a firm can benefit from having more explorative alliance experience with both former and unfamiliar partners. Despite these valuable insights, research on how the purchasing personnel manage explorative alliance relationships with their supply base or "dalliance" relationships with unfamiliar suppliers in DI projects remains rare.

Early purchasing involvement: organizational structure or parallel structures

There is a distinct lack of research on how to organize the purchasing department so that it can take a leading role in sourcing new technologies and supplier market spaces. As mentioned before, Schiele (2010) stressed the dual role of purchasing in NPD: supporting the process of innovation while at the same time maintaining cost and integration responsibility over the entire product life cycle. This duality suggests the presence of the classic exploration-exploitation "ambidexterity" paradox originally proposed by March (1991), who suggested that efforts to excel in exploration and exploitation naturally compete for scarce resources, such that they tend to crowd each other out.

Several studies on innovation have suggested that ambidextrous organization is a system that can handle both incremental and discontinuous innovations by exploration and exploitation activities. Based on this approach, Calvi (2000) demonstrated that many firms opt for a structural distinction between an "advanced (or forward) sourcing" department and a "strategic sourcing" department. The advanced sourcing team is integrated into all NPD projects, while the strategic sourcing team has a stronger commercial focus and is connected to internal customers. We can envision several different ambidexterity arrangements within the "advanced sourcing team" depending on the nature of innovation. The idea that DI requires a different organizational arrangement than that needed for incremental innovation is supported by Tushman and O'Reilly III (2006) and recently by Kortmann (2015), who suggest that the effectiveness of organization depends on the adaptability of oriented decisions and the nature of the innovation effort sustained by the exploration process.

An alternative approach to the challenge of ambidexterity for managing DI is offered by Bessant et al. (2010) Birkinshaw, Zimmermann, and Raisch (2016) and Gibson and Birkinshaw (2004). They suggest that ambidexterity should not be incorporated in the organizational structure as the deployment of both innovation practices for incremental and DI as it is likely to create tensions and conflicts inside the organization. Instead, organizations can develop organizational parallel structures. Recently, Gualandris et al. (2017) argued that purchasing functions will also need to establish these "parallel structures" to balance exploration and exploitation practices. Their analysis suggests that "purchasing functions may need to adjust their exploration-exploitation balance over time in order to match the dynamisms of their external environment" (p. 22).

In summary, although studies on technological discontinuity and organizational response have progressed and there has been a considerable amount of academic research done on the subject, since 2013 little empirical research has been done on purchasing practices developed by companies for managing DI projects. Traditionally, when purchasing becomes engaged in NPD projects, it is focused on continuous improvement. Yet, little is known about how the purchasing department involved in NPD projects under DI can adapt existing sourcing and supplier relationship practices to more exploration practices. Arguably, there are strong implications for purchasing departments, as the role of purchasing professionals in managing supplier research collaboration become more common and visible in a firm's innovation process (Luzzini et al, 2005; Pihlajamaa et al. 2017).

Research methodology

The HVAC industry –a discontinuous innovation context

The Heating, Ventilation, and Air Conditioning (HVAC) industry has seen a great deal of technological development in recent years due to the role of new regulations, i.e. the Energy Performance of Buildings Directive (EPBD) adopted in 2002 by the European Commission. The industry context has been extensively used in studies of DI (Durisin & Todorova, 2012). Therefore, we searched for an industry with a DI context known for its innovativeness.

Our focal company, which we here refer to as 'Anémos', has a strong manufacturing culture creating HVAC design and systems. Because of the ambition of companies to develop HVAC equipment with the objective of reducing energy consumption and a more sophisticated use of this equipment with appliances and electronics, it was important that Anémos search for external and alternative technological opportunities. By combining premium design, innovation and cutting-edge technology, Anémos has actively invested in renewable energy. 4% of turnover is invested in the company's R&D to provide a constant impetus for innovation. In 2006, it entered the renewable energy market, which in 2015 represented 12% of its turnover, and invested in a new state-of-the-art production line to improve its manufacturing process.

Hence, the HVAC industry context was suitable for this study because the four innovation projects selected for this research were regarded as attempts by Anémos to respond actively to increasing demands on a completely new market, technology, political regulations and customer expectations in the industry. According to Kishna et al., 2017; Phillips et al., 2006, these characteristics correspond to the sources of discontinuity.

Cases selection

R&D and purchasing managers actively participated in the case selection. Initially, there were discussions with them regarding suitable DI projects based on existing indicators that have already been used in a variety of empirical studies (e.g. Rice et al., 2002; Magnusson et al., 2003; Phillips et al., 2006b; Brentani and Reid, 2012; Bergek et al., 2013). The project selected had to respond positively to at least one of indicators e.g. *Is it an innovation project triggered by changes in the regulatory industry? Is it an innovation project that acts as a catalyst for the emergence of the new market? Does the innovation project require the application of new technology already in use elsewhere outside of the industry?? Does the innovation project require the intersection or combination of two technological domains?*

Four case studies were selected based on the logic of theoretical sampling (Eisenhardt, 1989). In contrast to the projects studied by Van Echtelt et al. (2008), which were based on NPD projects with different degrees of innovation, in this study theoretical sampling was designed

to enable one specific project: NPD under DI conditions. The projects defined and identified as DI projects by the purchasing and project managers were considered highly innovative projects involving new technological applications or solutions to challenging targets on environmental performance (similar to Magnusson et al., 2003 empirical work on DI). The four NPD projects often required technology that was not part of its firm's core competence (Golden, 1992) and posed significant challenges, such as the use of unfamiliar suppliers or new supplier collaboration (Bergek et 2013; Lambe and Spekman, 1997; Phillips et al., 2006). The list of projects and their descriptions are illustrated in Table 1.

Table 1 Summary of case descriptions

Project	**Discontinuous nature of project / salient details**	**Gate stage of project**	**Informants / Job titles**
Case A	The development of a new hybrid-heating system by the application of an alternative technology with the ambition to develop an HVAC product with high energy efficiency required with the objective of new regulations. Compared to a traditional heating system, this hybrid heating system can reduce CO2 emissions by more than 70%.	Commercialized (2009)	R&D heads of business unit and Purchasing heads of business unit and Purchasing director
Case B	The development of an innovative Triple Heating System by the application of a technology sensor connected to an electronic card that manages the maximum temperature in a regulating circuit. Traditional heating of towels operates with a mechanical system, which controls the safety temperature of the device by a circuit breaker.	Commercialized (2013)	R&D heads of business unit, Purchasing heads of business unit, Marketing heads of business unit, Purchasing director and Supplier (Thermo)
Case C	The development of an eco-design heater that is more aesthetically pleasing and slimmer than existing models. Idea fostered for the first time in collaboration with Purchasing and suppliers based on a potential new customer demand.	Product development (2015)	R&D heads of business unit, Project manager, Purchasing director, Purchasing heads of business unit, Buyer, and Marketing heads of business unit and Supplier (Sierra)
Case D	The development of compact radiators with the same objective of reducing energy consumption. Idea fostered for the first time in collaboration with the R&D and one supplier during innovative workshop meetings.	Concept planning (2015)	R&D heads of business unit, Project manager, Purchasing heads of business unit, Marketing heads of business unit, Buyer and Supplier (Sales and R&D manager from Ocean)

Data collection

Prior to conducting the main case studies, a pilot study involving eight face-to-face interviews in an automotive company was conducted. From the pilot study, we observed a structural distinction of the purchasing department into an advanced sourcing team integrated early in NPD projects and a life-cycle sourcing integrated later in the NPD, which has already been found in other studies on automotive companies (Schiele, 2010). This pilot study helped to refine research questions, the researchers' general understanding of purchasing involvement in DI and the accentuated need for more research on the organization of EPI in other sectors.

In our main case studies, purchasing representatives manage incremental and DI projects or advanced sourcing and life-cycle sourcing at the same time. Thus, our sampling perfectly fit with our research objectives of understanding how purchasing representatives adapt existing practices to exploration practices following prior theorizing that purchasing may need to adjust their exploration-exploitation balance in parallel in order to match the dynamisms of their

external environment e.g. DI conditions (Bessant et al., 2010; Gibson & Birkinshaw, 2016; Gualandris et al., 2017).

During the data collection, multiple sources of information were used: primary sources of information, such as interview transcriptions, factory visits, observations of business meeting events, and secondary sources of information, such as companies' websites, report and presentation materials provided by suppliers and Anémos enhancing the validity and reliability of the research. The use of multiple respondents in different projects allowed us to identify, to classify, and to compare purchasing practices and innovation results, although the focus was on a single company's strategy and organization (Dubois & Araujo, 2007).

In total, 30 face-to-face interviews across purchasing R&D and marketing departments and with suppliers involved in the four projects were conducted, each one typically lasted 2-3 hours. Interviewees were identified in consultation with Purchasing and R&D managers, following a "snowballing" approach, based on their project involvement. The interviews were semi-structured, aiming to capture the different perceptions of sourcing, supplier relationship and early purchasing involvement practices in the four projects. All interviews were recorded, transcribed, and sent to informants for verification, thereby increasing the confirmability of the case information (Lincoln & Guba, 2002). Recorded and verified data was all imported into and analyzed using NVivo 10 software.

Within case analysis

A thematic approach to data analysis within the case study was used to identify purchasing practices and emerging themes. The data analysis process consisted of labelling passages of the interviews according to the themes identified in the literature review and mentioned before: EPI, sourcing technology, scanning supplier market, purchasing communication, supplier dalliance, supplier alliance, and R&D and purchasing interaction (Miles, Huberman, & Saldaña, 2013). Then, the process was followed by data-driven codes or emerging codes (Strauss and Corbin's, 1998, Corbin and Strauss, 2008); meaningful emerging codes were: "advanced purchasing and marketing interaction", "purchasing challenges", "supplier day", "supplier research collaboration", "innovation purchasing strategy" and "recombinant innovations". From the initial thematic codes, emerging codes were aggregated into each main theme.

In order to analyses each case study as a stand-alone entity to conduct the comparisons between the four cases without losing important details, we adopted a within-case analysis (Yin, 2009). Thus, data was organized according to a time perspective by which the researcher tries to create a story from the different occurrences that are presented in the data. Each case was written by a chronological event-based account taking into consideration the main themes of the conceptual framework. During the event account when specific statements from interviews or conversations are used, a reference between brackets is made to the specific function that the persons fulfilled.

Case A: The hybrid-heating system

Since the R&D of Anémos did not yet have a lot of knowledge regarding renewable energy and involved technology in 2005, Anémos was forced to search for technology know-how outside of the company. To do this, a sourcing team of representatives from the Purchasing and the R&D departments had to work together to find suppliers with expertise in alternative technologies in the renewable energy market. Although a representative from the Purchasing department was involved in the sourcing process, this process was handled as usual: The R&D department gives primary specifications to suppliers, and Purchasing handles supplier selection

by their technological capability and cost price estimation. Then, the supplier selected becomes involved during the engineering phase of the NPD process.

The R&D representatives were confident about their technical knowledge on developing water heaters to carry out the project and to manage the supplier collaboration by themselves (ref: purchasing manager). Thus, the NPD project in case A started without active participation from the purchasing department. Although the NPD process appeared to be under the control of / controlled by the NPD project team, the project was operated by engineers who paid little attention to the relationship with this new supplier. In fact, the project was a very new technological solution for Anémos and the way to handle supplier relationships in this context was definitively also new (ref: purchasing director).

Consequently, uncertainties occurred with the planning and final cost of the product. As the project team did not know how to proceed with supplier collaboration, they contacted the purchasing director to help solve communication and organizational problems with the supplier. New agreements were arranged with this supplier for the final development, but after some time the supplier decided to terminate the collaboration with Anémos. However, in the period after this project was introduced onto the market, attempts were made to improve supplier collaboration in Anémos NPD projects. A key part of these improvements concerned how purchasing representatives could be earlier in NPD projects in order to enhance supplier collaboration. According to the purchasing manager and echoed by the R&D manager:

> *"The wrong choices or the bad decisions we did in this project related to supplier involvement and relationships [which meant] that we could not continue working jointly with the supplier in further innovations. If we had done the process of early purchasing involvement we're doing today, perhaps we would not be in a failure situation with this supplier" (Purchasing Manager)*
>
> *"Absolutely, and we could be bouncing on complementary innovations" (R&D Manager)*

Case B: The Triple Heating System

The purchasing department was not involved from the beginning of the NPD process in case B, but earlier than normal when it comes to identifying and engaging with new suppliers. R&D and Purchasing therefore worked together on searching and identifying suppliers by attending trade fairs and special events. The responsibility of the purchasing department was to select the appropriate supplier with the technical capabilities needed to develop this project but maintain the control of risk in the supplier selection (ref: purchasing manager).

After scanning the supplier market, Anémos had two suppliers who could support the project. One of these two suppliers was an unfamiliar supplier; that means this supplier had never worked for Anémos. This supplier was rich in experience in the application of this new technology. However, the purchasing manager decided to select Thermo. Thermo was a known supplier for the company, so the purchasing department did not need to ask them to participate in the supplier approval process. According to the purchasing manager:

> *"Anémos has not yet developed any strategy for unfamiliar suppliers. Therefore, it is difficult to take the risk, we do not trust suppliers before the supplier approval process, we are afraid that this supplier will take our know-how or technical expertise."*

During the project, Thermo worked closer than usual with Anémos to adapt this new generation of heaters to their business unit production. Anémos describes the relationship with Thermo as a good and close relationship based on open communication. Thermo in turn describes the relationship as a partnership, but in Anémos, the relationship with Thermo is not yet considered

a partnership, as a partnership agreement has not been signed. This partnership agreement, developed in 2014, consists of an engagement to share know-how, technical capabilities, and IP between buyer-supplier involving open communication with the goal to develop an innovative idea.

Although the new system had the potential for the company to not only capture market shares from current HVAC competitors, but also to substitute traditional heating of towels by combining the bathroom radiator and towel dryer, customers did not perceive a new value added from this technology (ref: marketing manager). In contrast to case A, this project created a sense in the company of a need to involve marketing function in the supplier involvement processes. One of the challenges learned from this project according to the marketing department is to share the expectations of Anémos customers with suppliers. That is, supplier integration in the innovation process needs to start by putting the customer needs in the central debate of an innovative idea.

Case C: The design-heaters

The design-heaters project does not only involve new technological processes, but a new organizational mode of Anémos' innovation process. In this case, the purchasing department was involved early in the NPD process and was thus a participant throughout the project. In fact, the idea to develop this NPD was fostered for the first time in the purchasing department.

The sourcing process for the design-heaters project in case C was very different from the traditional one (ref. purchasing and R&D managers). Instead of providing technical specifications to suppliers, the purchasing manager met suppliers to ask them if they were able to propose technical solutions to improve the aspect of the existing water-heater models. Since the request was neither precise nor clear, the purchasing department received many propositions that were difficult to coordinate. Therefore, the purchasing department decided to contact the marketing department in order to ask them what the important areas or themes to develop for product innovations were. The marketing department responded to the purchasing manager to work on two identified critical areas: comfort and eco-design.

The concept design and technical solutions were therefore provided by a number of suppliers. For the supplier selection process, purchasing organized a supplier day presentation. A supplier day consisted of presentations from suppliers to show what they had done to support the development of this project and propose different designs and solutions. From the Anémos side, there were representatives from the Marketing, R&D and Purchasing departments to listen to supplier propositions. Purchasing representatives, together with the representatives from the other departments, decided to select one supplier here referred to as "Sierra". Although Sierra was considered a new supplier for the R&D of Anémos, it was a known supplier for one of the purchasing managers.

> *"Sierra is a known supplier for me. I met this supplier from my prior experiences in other companies. Actually I've known Sierra very well for a long time.*" (the purchasing commodity manager).

Sierra demonstrated that they had processes and structures to handle a project with Anémos in a partnership relationship. Hence, they accepted to meet the CEO of Sierra group and Anémos' industrial director to show the importance of this project collaboration.

> *"We had not even started the project when the CEO of Sierra and our industrial director met and had already exchanged on their industrial vision and the vision of further business" (Anémos purchasing director).*

Anémos acknowledged that engaging in a co-innovation project at the early stage of NPD required a totally different interaction and communication pattern. To solve the technological system process issues of the first prototype, engineers from both firms worked together on a second prototype by visiting the supplier's production and vice-versa, engineers from Sierra visiting Anémos' production. The purchasing manager describes the relationship with Sierra as an engineer-to-engineer relationship, as engineers from Sierra and Anémos spent time together to test and find technical solutions. The R&D manager describes the relationship with Sierra as a good and close relationship based on well-defined agreements in terms of IP, royalties and responsibilities that protect both parties, resulting in transparency and mutual trust.

Case D: The design-heaters

Based on new internal processes for involving suppliers earlier into the NPD process set and formalized in Anémos in 2014, traditional organizational roles were reconsidered. The role of the purchasing director became a more strategic role in innovation, as he was now involved in the innovation committee with top management and strategy group directors' meetings to discuss HVAC industry trends. Consequently, one of the new responsibilities of the purchasing director was to provide advice to purchasing managers of different manufacturing sites about emerging innovation questions, new supplier collaboration modes, and research contracts with suppliers.

Moreover, the purchasing director set new objectives for the purchasing managers, such as identifying suppliers with strong technical capabilities and research expertise in NPD to sign a partnership agreement with them to develop new product ideas. Purchasing managers therefore had the responsibility to identify, to attract, and to motivate suppliers to work in a partnership relationship at the ideation stage of the NPD process. The marketing department in turn was now involved in the sourcing process by presenting the market context and customer expectations to the purchasing department.

The sourcing process in case D started by identifying innovative suppliers from the supply base and asking them to share know-how, technical capabilities, and research to develop a NPD project. The purchasing department elaborated, together with the R&D and Marketing departments, a Power Point presentation around Anémos' customer expectations and the HVAC technological trends to present to pre-selected suppliers. Then, the purchasing department coordinated and organized an innovation meeting with each supplier. The innovation meeting started with a brainstorming about the HVAC market and Anémos products followed by the historical buyer-supplier relationship between Anémos and the supplier selected. Anémos also invited suppliers to do the same presentation to start a mutual trust and transparency buyer-supplier relationship. This meeting finishes with the signature of a research contract and confidential agreements where suppliers accept to respect confidential issues and to be engaged in sharing of expertise, technical capabilities, and IP to reach the development of new product innovations.

After different innovation meetings with suppliers, representatives from the R&D department and Purchasing department selected one supplier, referred to here as Ocean. According to the purchasing department, Ocean was always suspicious of the way Anémos managed its co-development projects; therefore, it had been a long time since both companies had worked together on an innovation project.

The NPD team initially met to work on creativity workshops, which consist of discussion about potential product innovations, ideas, technological trends, and solutions (ref: R&D manager). Creativity meetings were run with different propositions to develop incremental and radical product innovations. The challenge of the design-heaters project is for Ocean to have a general

vision of the concept design of radiators. R&D from Anémos describes the relationship with Ocean as good and more open based on mutual trust and interest. Ocean in comparison describes that the buyer-supplier relationship in a NPD under DI can sound like an opportunistic strategy. According to representatives from Ocean*:*

> *"Maybe it is only sounds opportunistic. I think that in order to have suppliers participating in the same fruitful way customers need to be able to be quite open, to have a clear discussion, to communicate if customers want suppliers believe in their co-innovation projects and be engaged."*

Cross-case analysis and discussion

In this section, the cross-case analysis (table 2) is used to answer our two research questions into how the purchasing department involved in NPD projects can adapt existing practices as an attempt to respond actively to DI. These practices are discussed and propositions are developed in the following:

Discontinuous innovation

As can be seen in table 2, the majority of cases are characterized by technological discontinuities. Two of them, C and D, are characterized by creating distinctive product characteristics aimed at different market segments or potential customer needs. Case B is the only project characterized by creating value through a marketing or branding dimension; this implied that in this case no evidence of emerging purchasing practices was observed as un unexpected finding. Despite this, one similar pattern across case studies was found. This pattern was suggested by most respondents, the successful NPD projects under DI conditions often required the involvement of new actors in the NPD process (e.g. suppliers or customers), consequently different NPD organizational forms.

Technology Sourcing

The cross-case analysis identified an alternative sourcing process. In effect, sourcing practices in cases C and D were different from cases A and B. In cases C and D, sourcing new technology from suppliers without having any product specifications or a NPD project in mind required the use of different scanning methods. The "*reversed"* sourcing process, as the purchasing representatives call it, consists of using a variety of exploratory practices to scan the supplier market. For instance, in case C, an "idea competition" mechanism was deployed to scan the supplier market. In the open innovation literature, idea competition builds on the nature of competition as a means of encouraging users to participate in an open-source projects (Piller & Walcher, 2006; Von Hippel, 2007).

In this study, the idea competition began by sending out a bid invitation to suppliers that are believed to have the necessary technical competences to participate in this activity. This finding was similar to the case of Sjödin and Eriksson (2010), but in their case, the idea competition was performed by the R&D department. The management of product ideas and/or new technological solutions from different suppliers resulted in several challenges for the purchasing department to coordinate, filter, and evaluate them or, in purchasing terms, to select and evaluate suppliers. Surprisingly, the reversed sourcing process involved mainly interactions with external partners as well as different functional areas and hierarchical levels. According to Soukhoroukova, Spann and Skiera (2012), the involvement of several disciplines is the best way to filter and to evaluate new product ideas from an idea competition. Moreover, this finding

supports the important interaction of customer-facing marketing executives in a complex DI environment also found in Song and Di Benedetto's (2008) work. In cases C and D, customer expectations provided by the marketing department facilitated communication of supplier tasks required for evaluating the quality of product idea submissions.

Table 2 Cross-case analysis

Analytical dimensions	Case A	Case B	Case C	Case D
Discontinuous innovation	*"Really" new technological solution (Purchasing and R&D managers)*	*New marketing approach (Marketing manager)* *The concept of this heater application has already used in others industry applications, therefore, but I think for Anémos it was a kind of different marketing approach. (Supplier)*	*…a revolution in the world of water heaters (purchasing manager)* *Radical innovation with different technical solutions, adaptations, and architectures with major implication.* *(R&D manager)*	*A new product lines (Marketing manager)* *Potential discontinuous innovation (R&D manager)*
Early Purchasing Involvement	*We could not be analytical about what was written in the specifications stage because we lack of knowledge. We realized after when we had difficulties in the level of product quality and to get everyone's responsibility. (Purchasing manager)*	*Buyers of Anémos know well the technical of products. (Purchasing Director)* *We have buyers who have technical engineer background. (R&D manager)*	*Sierra is a known supplier for me, I met this supplier from my prior-experiences in NPD projects with other companies, and actually I know Sierra very well since long time (Buyer)*	*The role of EPI was to be contributor of product ideas and innovations and to be ground in the relationship of our suppliers in the case of this project.(Marketing manager)*
Sourcing technology	*We had no technical knowledge for the development of this project, so it was broadcast on an existing panel focused on Europe; we said we need someone local. (Purchasing manager)*	*The technology operates by suppliers must be close enough to our products* *(R & D manager)*	*In sourcing new technology or product ideas, we search for a supplier with a common interest. If we have not a common interest, there cannot be a deal.* *(R & D manager)*	*We are in search for suppliers who have a know-how, strong technical capabilities and motivation to be able to work in the mode of research collaborative projects (Purchasing Director)*
Scanning supplier market	*In this project, two trade fairs in Europe allowed us to have a maximum of suppliers (Purchasing manager)*	*We did not have the technical solution in the R&D to develop this project, so the purchasing and R&D departments go to trade fairs and conferences to identify potential suppliers (Purchasing manager)*	*We returned to our suppliers and we ask them not to work on everything, we said that we need ideas or technological solutions to improve the aesthetic of Anémos products and then we ask them to propose us something new. (Purchasing manager)*	*The purchasing department organized the meeting between the R&D department and the supplier for a period of brainstorming (Purchasing manager)*
Purchasing communication with suppliers	*We somewhere segregate a little the supplier relationship, saying to the supplier, we have a need*	*Anémos asked for specific technology application (Supplier)*	*The supplier asked me if they could propose something for the aesthetic of Anémos products, I said yes, you prepare a presentation, and I will*	*We had not even started the project when the CEO of the supplier and our industrial director met and have already exchange on*

	and you respond to the need (R&D manager)		*organize a meeting with the Purchasing and R&D directors (Buyer)* *Usually, the exploration or research phase is done with institutions, schools or research centers, sometimes with suppliers, but is rare. Often, when we start talking about a new product with suppliers is because the supplier has a new technology to sell. This project is the first case that we work with a supplier in the exploration phase in a free, open and unscheduled climate. (Project manager)*	*their vision and the vision of further business (Purchasing Manager of Heating)* *The research contract is a global contract where the objective is to start a relationship with the supplier in an open communication climate, technical sharing and transparency suitable for the development of product innovations (Purchasing manager)*
Purchasing interaction with other departments	*Clearly, it is the role of the purchasing department to ensure that suppliers have a place in the R&D activities, and to avoid the NIH syndrome, because we are talking about new ideas which come from suppliers, not from us. Purchasing should push for integrating supplier ideas and these ideas being well accepted. That is why, the people who go to visit supplier sites are the purchasing and the R&D department (Purchasing Director)*		*There were the Marketing, the R&D and other functional departments at the supplier presentations, so it is created exchange. It is part of the new EPI strategy. (Marketing manager)*	*The communication between purchasing, R&D and marketing is now part of the corporate strategy; This strategy allowed us to put the customer in the center of the supplier technological exchanges (R & D manager)*
Supplier technical exchange	*After these projects, we realized that we had suppliers that we work with for 15 years ago now, they did not even know our products, and they did not know what is going go in the HVAC industry. It is extraordinary, we must do something, we should get closer to them (Purchasing Director)*		*Engineers from Sierra come here (Anémos manufacturing site) to spend time testing the prototype, we also go its place to study the project. It happens by an engineer-engineer relationship. (Purchasing manager of Water Heating)* *It is a win-win project, we will be able to grow through innovation, and we will be able to bring him a technology or expertise that could not develop for himself. (Supplier)*	*Before, we had a product idea and we selected a partner to develop it. But in this approach we are not in a co-innovation. The co-innovation is the fact of getting together a product idea, thinking together this idea and shares our technology knowledge to develop a new product as in this case. (R&D manager)*
Supplier research collaboration	*The bad choices or the bad decisions that we have made on supplier research collaboration during this project result in a broken supplier relationship that we cannot continue to work jointly with the supplier (Purchasing manager)*	*N/A*	*It was about working on finding new solutions for Anémos products to fit better in the home, the purchasing department worked jointly with the supplier by asking to propose something new and it works well, confident enough to get two solutions until a prototype, so a ready-product (Marketing manager)*	*It seems that there were uncertainties in the organization how to handle a supplier, because before we worked a close and strong partner and then; the strategy was not being so open so during a year or two years it was not so clear how to be. Now since a couple years we are not back to the same partnership we will never be probably, but is open and a good relationship. There is a research contract, before there was not contract. The IP is clear (Supplier)*

Recombinant innovations	*N/A*	*N/A*	*It was about working on finding new solutions for Anémos products to fit better in the home, the purchasing department worked jointly with the supplier by asking to propose something new and it works well, confident enough to get two solutions until a prototype, so a ready-product (Marketing manager)*	*Suppliers before proposed existing technologies because they did not want to take risks sharing new trends, technologies, ideas and so on. With this new agreement supplier had more confidence to share them because IP and confidential issues are negotiated before the project. This is good for Anémos because it means that we are in advance regarding new technological knowledge and solutions from suppliers (R&D manager)*

Therefore, we develop the first proposition as the following:

P1 *Interactions between purchasing and marketing departments at the early stages of the NPD process can enhance exploratory sourcing practices required for DI.*

The purchasing manager in case D developed a similar reversed sourcing process pattern. An important observation was the differences in supplier involvement practices from the purchasing manager in case D. In case C, the purchasing manager invited different suppliers in the supplier market to participate in NPD ideas whereas the purchasing manager in case D pre-selected suppliers from the supplier base that could participate in NPD ideas. Although the scanning method of the purchasing manager in case D was limited to pre-selected suppliers and coordination of supplier technical exchange rather than exploring a large number of suppliers like the purchasing manager in case C, findings indicate that the scanning of the supplier base can also generate radical NPD ideas or architectural NPD. This is consistent with some studies, particularly Bozdogan et al. (1998) and Subramanian & Soh (2017) studies. This leads to our second proposition:

P2 *Scanning the supplier base through EPI can introduce discontinuity in the NPD process.*

Supplier relationship

The findings indicate that transparency, alignments and socialization were important mechanisms to successful supplier technical exchange early in the NPD process required under DI conditions. The findings also suggest that the occurrence of a number of supplier collaboration problems in case A can be partially attributed to the inefficiency or absence of these mechanisms.

As can be noted in table 2, efforts on supplier relationship were carried out for NPD projects in cases C and D. Firstly, two pro-active innovation meetings served to promote internal supplier technical exchange in Anémos. One meeting was initiated in case C and consisted of supplier presentations on product propositions to improve the aspect of heating-waters. This meeting was an opportunity to discover new suppliers that had been working for Anémos providing specific components, but they had never been involved in NPD projects. The same pattern was found in case D where a similar meeting convinced a historical supplier to work on a NPD project with Anémos. As mentioned before, informal innovation meetings were organized by the purchasing department with the objective to convince suppliers to participate in open discussions with the representatives of the R&D of Anémos to develop NPD ideas jointly.

Alignments in Anémos were developed through socialization practices which were similar to the Japanese practices, for example informal meetings to share cultural, technology and market goals for the development of potential innovation projects (Cousins et al., 2011; McDermott & Handfield, 2000). The purchasing department was responsible for assuring the alignment of suppliers with Anémos' innovation strategy by organizing informal and formal pro-active innovation meetings. Schiele (2010) defines these proactive "innovation meetings" as supporting tools used by the purchasing department to create technical ideas originating with suppliers and to support the firm's process of innovation.

P3*: Innovation meetings with suppliers organized by the purchasing department can enhance supplier technical exchanges early in NPD that in turn can facilitate the development of DI.*

However, the supplier in case D defined these proactive innovation meetings as an opportunistic strategy. It appeared that combination of a potential long-term relationship and a "dalliances"

short-term relationship (Phillips et al., 2006) is in fact hidden during these innovation meetings. For example, it was noted in case C that the NPD process was purely driven by supplier innovation. That is, the supplier developed the first prototype and it was responsible for the development of a second prototype. Anémos only provided the equipment and facilities to test the prototypes. If at the end of the testing stage, Anémos realized that the NPD would not be feasible because the prototypes were not working, Anémos had the right to stop the project, and the supplier had the right to offer or to sell the prototype to other customers. Therefore, a kind of dalliance supplier relationship at the ideation stage was identified.

> ***P4:*** *A combination of supplier dalliances and potential long-term relationships can help to convince suppliers to work in an exploratory NPD collaboration under DI.*

Early Purchasing Involvement

The findings from this study provide a distinct view of purchasing's importance in NPD under DI conditions based on the timing of purchasing involvement. That is, in contrast to prior research, which points out that the role of purchasing in NPD under DI conditions has limited influence (Melander and Lakemond, 2014), our findings demonstrate that purchasing's role and importance in NPD under DI conditions depends on the timing of purchasing involvement. More specifically, in cases C and D, the involvement of purchasing managers at the ideation stage of NPD contributed to a large number of new suppliers' product ideas and technological advances for NPD needed under DI conditions.

For Tushman and O'Reilly III (2006) and Kortmann (2015), the effectiveness of organization's DI capacity depends on the exploration process where DI requires a different organizational arrangement than incremental innovation. In this study, it was found that the organizational implementation of an Early Purchasing Involvement (EPI) supports the exploration of new product ideas or technology from suppliers required in the context of DI. Similar to Kortmann's (2015) work, which emphasizes the significant role of strategic leadership in implementing ambidexterity-oriented decisions for the development of DI, our study shows that the top management decision to implement EPI encourages purchasing representatives to adapt existing purchasing practices to more exploration practices into new technology or ideas from both former and new suppliers. Moreover, this study found that the implementation of EPI contributed to cross-functional team structures such as top management, marketing, R&D and purchasing interaction. This leads to the following proposition:

> ***P5:*** *The organizational implementation of EPI at the strategy level can encourage purchasing managers to adapt existing sourcing and supplier relationship management practices as required for DI.*

Moreover, the findings of this study show that although two different sourcing processes were found, there is no evidence of potential structural distinction of the purchasing department to pursue effective exploration practices (Schiele, 2010; Calvi, 2000). Actually, it appears that the *reversed* or alternative sourcing process was the result of the involvement of purchasing at the early stage of NPD rather than an official or well-documented process. Thus, it can be argued that explorative sourcing practices are developed in a "parallel" structure as suggested by Birkinshaw et al. (2016), Gibson and Birkinshaw (2004) and Gualandris et al. (2017).

Based on our case study findings and propositions, we develop a framework of early purchasing involvement practices for DI (Table 3). The framework sets out three purchasing themes,

comprising six purchasing practices and their definitions that could facilitate supplier research collaboration in NPD under DI conditions.

Table 3 A framework for purchasing involvement practices for NPD under DI conditions

Sourcing	
Scanning the supply base	Pre-selecting suppliers by technical capability, historical supplier relationship and R&D resources Communicating new market axes to supply base for future collaboration in innovation projects Coordinating pro-active innovation meetings with the supply base
Scanning the supply market	Establishing an "idea and/or design competition" activity by involving the supply market Asking suppliers to provide new product ideas or technological solutions based on potential customer expectations Organizing supplier day presentations
Supplier relationship management	
Collaborative "dalliance" relationship	Organizing face-to-face discussions with suppliers to work on further specifications Organizing innovation meetings to share and to align market, technology and business culture goals with suppliers Coordinating review meetings
Evaluating supplier collaboration at the ideation stage of NPD	Establishing and communicating confidentiality agreements to frame the openness and transparency for future collaboration in innovation projects Providing feedback to suppliers about their technological solutions offered that can be used for the development of new products
Early Purchasing Involvement	
Organizing advanced technology sourcing	Attending internal meetings focus on firm's innovation strategies Promoting supplier integration knowledge into firm's innovation process Outlining the objectives of all buyers regarding supplier innovations Establishing and communicating targets of product innovations with suppliers
Exchanging new STK information with Marketing, R&D and Top management	Gathering information on customer expectations from the marketing department Selecting suppliers by involving R&D and marketing Coordinating supplier's ideas and product planning propositions with R&D and Marketing Organizing innovation meeting between the Top management of both companies from buyer and supplier

In summary, the formal organization of EPI in NPD projects under DI conditions in Anémos assessed a purchasing department pro-active in the searching and integration of former and unfamiliar suppliers into the NPD process. The cases C and D are the outcome of this formal organization implemented in 2014. Both projects are ongoing, so while it is too soon for a final evaluation of the implementation of EPI in NPD performance (e.g. profitability goals), we can still analyses its achievement and shortcomings to estimate some benefits of this involvement. In table 2, we can observe an improved supplier collaboration, supplier technical knowledge exchange, and access to new supplier's knowledge and capabilities in both projects. The improvements can be associated with the result of significant learning experiences by adapting traditional purchasing practices to explorative purchasing practices. Similar to Subramanian and Soh (2017), the findings of our study further imply that a firm's potential absorptive capacity for exploring and integrating supplier ideas, knowledge and/or capabilities into the NPD process can be enhanced by prior purchasing experience on DI projects.

Conclusion

Previous studies suggest that managing NPD under the context of DI requires firms to learn and adapt new innovation practices (Anderson and Tushman, 1990; Bessant et al., 2010; Tushman and O'Reilly III, 2006). The purpose of this paper is to provide new insights into how purchasing involved in NPD projects can adapt new innovation practices as an attempt to respond actively to DI. Each project was able to capture new and alternative practices developed by purchasing representatives involved early in the NPD process under DI conditions. We seek to conceptually advance the role of EPI in NPD under DI conditions and we derive propositions.

Theoretical and managerial contributions

We contribute to recent research on purchasing involvement, ambidexterity and discontinuous innovation by providing empirical findings of how purchasing (departments) involved early in the NPD process adapt sourcing and supplier relationships practices for DI projects. Similar to Bessant et al. (2010) Birkinshaw et al. (2016) and Gualandris et al. (2017), we identified new purchasing practices for DI projects which are combined with existing purchasing practices as parallel structures. Thus, we suggest that the implementation of EPI organizational form at the strategy level can encourage purchasing managers to adjust their exploitative practices to explorative practices as required for DI.

We propose a framework of purchasing practices that can be used as an initial instrument by consultants, project managers, and purchasing managers for evaluating existing purchasing practices in NPD under DI; guiding the implementation of alternative or explorative purchasing practices. This framework may enable the purchasing department to differentiate between traditional purchasing practices for NPD projects and the use of explorative practices for NPD projects under DI conditions.

Limitations and future research

The case study method was appropriate since it allowed for flexibility as the scope and aim of the study were adjusted over time. However, a common critique to the method is its limitation in terms of generalisability. Another limitation was the number of respondents in each case. In case A, it was not possible to gain access to one of the supplier and marketing representatives. The relationship with the supplier involved in case A was broken after this project. The marketing manager involved in this case had left the company when the interviews were started.

An interesting area of investigation (only touched upon in this study and not investigated thoroughly) is with respect to the "dalliance" supplier relationship strategy, more investigation into how purchasing manages transparency, socialization and alignment within this strategy is needed. In addition, it would be of interest to examine the supplier perspective in a dalliance relationship. In this study, it was found that dalliance supplier relationships with an existing supplier created the feeling of "opportunistic behavior" from the supplier perspective. In contrast, it was found that dalliance supplier relationships with new suppliers created the feeling of "challenge and commitment" to participate in a NPD project with a potential customer.

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Appendix A. Overview of the literature on purchasing involvement in NPD under discontinuous innovation

Study	DI conditions	Method	Focus	Purchasing department's role	Findings	Journal
Lambe and Spekman (1997)	Discontinuous technological change	Literature review	Technology-sourcing, alliances and NPD	N/A	Firms should determine what technology is critical for long-term strategic interests and ensures that they absorbing this technology from their alliances.	Journal of Product Innovation Management
Bozdogan et al. (1998)	Architectural product	Survey and case studies	Early supplier integration	N/A	Significant benefits have been found by proactively integrating suppliers in the system product architectures.	R&D Management
Ragatz et al. (2002)	Technology uncertainty	Survey	Early supplier integration	N/A	When breakthrough technologies are being developed, supplier integration becomes critical in achieving desired objectives e.g. concept to customer development time and quality.	Journal of Business Research
Petersen et al. (2003)	Technology uncertainty	Case studies and survey	Early supplier integration	N/A	Supplier integration on a NPD project requires a detailed formal evaluation and selection of potential suppliers prior to consideration for involvement.	Journal of Product Innovation Management
Magnusson, Lindström and Berggren (2003)	Discontinuous innovation projects	Two case studies	NPD	N/A	Adapting the organization in order to manage architectural and modular innovations. Suppliers engaged in early stages of innovation process to ensure consideration of manufacturing issues.	
Phillips et al. (2006)	Discontinuous innovation projects	Case studies	Supplier relationship	N/A	In seeking a discontinuous technology, buyer may use supplier relationships as strategic "dalliances" – short-lived relationship but result in learning for both parties.	R&D Management
Schiele (2010)	Discontinuous innovation (mentioned)	Consortial benchmarking method	Early supplier integration	Helping to define technology roadmaps Planning and conducting supplier innovation meeting Scanning the supply market for new and unknown components.	The internal organization of the purchasing department into an advanced sourcing unit which supporting innovation processes with suppliers and a life-cycle sourcing unit which controlling for cost issues on a firm-wide basis.	R&D Management

Sjödin and Eriksson (2010)	Process equipment uncertainty	Case studies	Supplier integration /open innovation	Establishing joint objectives Holding workshops Facilitating joint problem-solving Conducting team-building activities	Strong supplier integration was chiefly based on careful supplier selection coupled with incentives and collaborative tools (e.g. joint project office, joint project objectives, joint IT tools and team building activities).	International Journal of Innovation Management
Rohrbeck (2010)	Discontinuous technological change	Case studies	Technology sourcing	N/A	Technology scouting can support sourcing of technologies by identifying opportunities and threats at early stage	R&D Management
Athaide and Zhang (2011)	NPD under discontinuous innovation	Structural equation model	Buyer-supplier relationship	N/A	Development of customized innovations calls for co-development relationships, while discontinuous innovations require an emphasis on unilateral, education-based relationships.	Journal of Product Innovation Management
Bengtsson et al. (2013)	Technology uncertainty	Survey	Early supplier integration	Identifying, managing and integrating supplier technological knowledge. -Promoting innovation performance of the firm.	Internal knowledge integration capability in terms of proficient purchasers and applying cross-functional decision in supplier integration under DI conditions are beneficial.	International Journal of Technology Management
Luzzini et al. (2015)	Technology uncertainty	Survey	Purchasing and supplier involvement	Strategic souring management and supplier-buyer relationship	Investing in buyer-supplier collaboration (supplier integration, supplier involvement and development) processes is critical in the presence of technology uncertainty	Industrial Marketing Management
Pihlajamaa et al. (2017)	Technological novelty	Case studies	Supplier innovation	N/A	Supplier management capabilities are needed in different phases of the absorption process. Supply market intelligence capability is needed at the acquisition phase, negotiating and contracting capabilities in the transformation phase, and supplier relationship management and collaboration capabilities in the exploitation phase	Journal of Purchasing and Supply Management

The social foundations for innovation collaboration in business to business relationships

Bruce D. Pinnington*
University of Liverpool, Management School, Chatham Street, Liverpool, UK, L69 7ZH.
Tel: +44 151 7953642, email: b.pinnington @liverpool.ac.uk
*Corresponding author

Rima Ayoub
IMT Atlantique, Department of Management and Social Sciences, La Chantrerie, 4, rue Alfred Kastler, BP 20722, 44307, Nantes, France. Tel: +33 (0)2 51 85 85 52, email: rima.ayoub@mines-nantes.fr

Abstract

Innovation is a recognised source of competitive advantage for commercial organizations and is a cornerstone of European Union (EU) economic policy and business growth assistance programmes. Collaboration in turn is an essential enabler of innovation, particularly in a business to business context. This grounded theory study of collaborative social processes, highlights the importance of personal competences and social compatibility, above organisational compatibility, for new relationship development. The research has implications for new relationship formation in supply chains and peer alliances, especially in an innovation context where diverse experience and knowledge sources are required.

Keywords

Innovation, Collaboration, Social Capital.

Introduction

Innovation, particularly among SMEs, is a prominent feature of public policy for economic growth. This importance is illustrated in Europe by the current round of European Union investment. The European Commission (EC) and the European Investment Bank (EIB) are dedicating €33.5Bn of direct investment, as part of a €500Bn programme, designed to promote economic development, including help for an estimated 290,000 SMEs (European Commission, 2017). Eight billion euros will flow directly to SMEs that have an ambition to grow, irrespective of their research orientation (European Commission, 2016).

Collaboration provides the platform through which innovation relationships are formed and developed, and as such has been described as the *sine qua non* of innovation management (Dodgson, 2014). Collaborative relationships expose firms to diverse knowledge sources, new ideas and complementary resources through which radical and even market changing product and process developments occur (Berghman, Matthyssens, & Vandenbempt, 2012). Although the process may sometimes be unwieldy, under the right circumstances innovations can lead to significant improvements in business performance (Kanter, 2012).

The establishment of appropriate collaborative relationships is complicated in an innovation context, because countervailing forces act to narrow the range of appropriate partners. On the one hand the most radical, novel and potentially valuable ideas arise from distant, exploratory

relationships (March, 1991). On the other hand, an organization's ability to learn from, and use such knowledge, its absorption capacity, is related to what the organization already knows (Cohen & Levinthal, 1990). Therefore, there is an optimal point at which collaborators are sufficiently distant that novelty exists, but close enough such that the cognitive distance does not compromise the exploitation of an idea (Enkel & Heil, 2014; Nooteboom, Van Haverbeke, Duysters, Gilsing, & Van den Oord, 2007). The more that potential collaborators share in common, the more knowledge they can absorb.

Through social capital theory, we know that extensive networks increase the prospects of links being established with innovative sources (Burt, 1992), but less well established, especially in a business context, are the social processes through which ties are formed and developed into effective and productive collaborative relationships.

Much of the literature relating to innovation collaboration is based in University to Business (U2B), rather than Business to Business (B2B) studies, particularly in 'high velocity' sectors such as biotechnology, electronics and telecommunications (Eisner, Rahman, & Korn, 2009). Biotechnology is a particularly popular research context because of prevalence of researchable patents (Howard, Steensma, Lyles, & Dhanaraj, 2015). Much less is documented about how contacts across networks of B2B organisations can be better developed into productive relationships that in turn, will realise the outcomes envisaged by public policy makers.

Collaboration research is also typically undertaken at an organisational actor level, despite collaboration being fundamentally a social phenomenon, such that the role of individuals and social processes in collaboration has "largely escaped scholarly attention" (Schillebeeckx, Chaturvedi, George, & King, 2016, p. 1494). Collaborative relationships are not all equally effective (Al-Laham, Amburgey, & Baden-Fuller, 2010; Vlaisavljevic, Cabello-Medina, & Pérez-Luño, 2016) and an understanding of personal characteristics and social intricacies can provide insights into the reasons for those differences.

The underplayed role of individuals (Emberson & Storey, 2006; Gligor & Autry, 2012) assumes organisations are populated by a homogeneous, malleable and randomly distributed group of individuals (Schillebeeckx et al., 2016) that ignores individuals' characteristics and preferences. In order therefore, to increase the number of, and efficacy of collaborative B2B relationships, it is vital that knowledge relating to the social processes underpinning business collaboration is extended. The research therefore adopts a social perspective to address the question: how may we increase the number of business collaborations and the innovation potential of those relationships?

Literature Review

Innovation potential is recognised to be highest where individuals are exposed to new ways of thinking, and different experience (Corsaro, Carla Ramos, Henneberg, & Naudé, 2012) and diversity among its technical partners (Lucena & Roper, 2016). For firms, this means that contacts outside their normal sphere of collaborative relationships may have the greatest potential for inspiring product, process or technology related changes that may improve their competitive position.

Whilst, existing ideas can be incrementally *exploited* to realise their full innovation potential, the most radical, novel and valuable ideas arise from distant, exploratory relationships (March, 1991). The more distant the source of knowledge, the more innovation potential it may have, but also the more difficult it becomes to understand and to realise that potential. This distance has been termed the *cognitive distance*, exhibits an inverted 'u' shaped relationship with

organisational learning (Enkel & Heil, 2014). An organisation's ability to absorb knowledge is its absorption capacity, and is highest where that knowledge most closely relates to knowledge already absorbed by members of the organisation (Cohen & Levinthal, 1990). Inverted 'u' shaped results are also reported between innovation performance and innovation search strategy (Laursen & Salter, 2006), where again a point is reached, beyond which, it is more expensive to search for innovation potential that can be absorbed.

Absorptive Capacity

Given the potential inherent in distant contacts, even large organisations should no longer consider innovating alone (Pisano & Verganti, 2008). Organisations need to ensure that they seek ideas from broad enough sources, both internally and externally (Hansen & Birkinshaw, 2007), whilst also ensuring that they have an absorptive capacity appropriate to the complexity of knowledge being assimilated. The absorptive capacity needs to be sufficient not just to transfer the knowledge into the organisation, but also so translate this into tangible value, something which many companies do poorly (Hansen & Birkinshaw, 2007).

Absorptive capacity differs between firms and is enhanced by a firm's ambidexterity (Lucena & Roper, 2016) and the establishment of social capital. Vlaisavljevic et al. (2016) show, for instance, that relational social capital can extend an organisation's ability to absorb knowledge from diverse partners, where trust leads to a greater willingness to bridge cognitive gaps. Through direct and prolonged collaboration, groups not only establish trust, but also are able to exchange complex tacit knowledge based on "intensive, repeated interaction" (Molina-Morales & Martínez-Fernández, 2009, p. 1015). Rich social ties, in which individuals are connected through multiple routes, further enhance innovative knowledge transfer (Aalbers, Dolfsma, & Koppius, 2014). The dependency on close relationships also explains why firms that attempt to access technical innovation by buying-in technical resources, fail to develop an internal capability capable of accessing the critical tacit knowledge that is the basis for genuine competitive advantage (Al-Laham et al., 2010).

Whilst complex knowledge transfer depends on close inter-personal links, weak-ties are sufficient for the transfer of highly codified information, and indeed the sharing of innovative ideas is better facilitated through weak-tie networks (Hansen, 1999).

Social capital theory and innovation

The tension between location of innovation sources and the potential to absorb complex knowledge from those sources illustrates the two primary mechanisms underlying social capital theory. The first relates to weak-tie networks through which innovation sources may be located, whilst in the second, close inter-personal bonding capital provides the basis for complex knowledge exchange.

Social capital theory distinguishes the weak social links of acquaintances (weak-ties) from the close, social bonds of cohesive groups (strong-ties), and proposes that weak-ties provide superior access to new knowledge and contacts, where these links bridge previously disconnected groups (Granovetter, 1973). Members of closely knit groups share much of each other's knowledge, but weak-tie bridges give members of connected groups access to new contacts and information (Granovetter, 1973, 1983). These weak-ties are a source of informational power to the bridging individuals. Weak-ties require much less time to establish and to maintain than strong ties, so that considerably more ties may be maintained, as long as they remain weak (time spend developing those relationships will be at the expense of extending that person's weak-tie network). Individuals with many weak-ties are best placed to diffuse ideas quickly to the largest number of targets (Granovetter, 1973). Bridges are most

valuable when diffuse social networks contain structural holes that the weak-ties bridge (Burt, 2000).

Strong-tie group relationships also confer advantages on group members. Groups of closely linked individuals share information sources and develop social capital through shared meanings and normalised values (Coleman, 1988). This bonding form of social capital leads to the development of trust among group members that facilitates commitment and responsive action.

Effectiveness of the bridging and bonding forms of social capital

The relative merits of bonding versus bridging forms of social capital are widely discussed in the literature. From a contingency perspective, it has been suggested that each has merit depending on the nature and uncertainty of the task. Social closure (high bonding) is better suited to complex and uncertain problem solving, however, where tasks are more certain but information or resource access are concerns, then network bridges provide for a more cost-effective means of access to a wider range of resources (Adler & Kwon, 2002). In an inter-organisational context, the tie-strength between collaborating groups in each organisation is an important consideration. Whilst weak-ties are sufficient for the transfer of highly codified knowledge, strong-ties are needed to enable the transfer of complex and non-codified knowledge (Hansen, 1999). Rich-ties, in which multiple links are established between collaborating groups, have also been linked with enhanced transfer of complex knowledge (Aalbers et al., 2014).

Ultimately however, the effectiveness of social capital is contingent on factors beyond structural network conditions and tie-strength. The existence of a bridge across a structural hole is not in itself enough to generate social capital: "Brokerage opportunities do not by themselves turn into success, and people are not equally comfortable as brokers between groups" (Burt, 2000, p. 383). Actors must be willing to utilise their social capital; they must have the opportunity and capability (Adler & Kwon, 2002), and have an expectation of success (Nahapiet & Ghoshal, 1998). The establishment of social capital is therefore contingent on personal as well as network and task factors.

Social capital should not be regarded solely as a beneficial resource (Adler & Kwon, 2002; Nahapiet & Ghoshal, 1998), as forms useful for one purpose may be ineffective or detrimental to other purposes (Coleman, 1988). A preoccupation with contrasting the relative benefits of the bonding versus bridging perspectives has meant that negative facets of social capital are underplayed (Portes, 2000). Close bonding can lead to the exclusion of outsiders and isolation from outside information, whilst social norms can restrict initiative (Portes, 2000). These factors can stifle external collaboration and preserve the status-quo in businesses. It has also been suggested that close bonding leads to a convergence of ideas, beliefs and knowledge that stifles creativity.

Method

This research considers how the number of business collaborations may be increased, especially those featuring innovation, via a better understanding of the social processes through which such relationships are established. The context is provided by European Union strategic policy, in which innovation and collaboration involving SMEs is at the heart of plans for economic development.

This inductive, qualitative study explores inter-organisational collaborative practices across a broad range of contexts including: vertical supply-chains, horizontal peer-peer collaborations, and complex consortia featuring both vertical and horizontal relationships. A qualitative study is suitable to the exploration of complex social phenomena where even the more obvious behaviour may depend on intricate social organisation (Silverman, 2013). An emergent inductive design was chosen for its flexibility in exploring relevant but unexpected insights. Grounded theory was adopted because of its social process focus, sampling approach and theory generating capability. Established grounded theory recommended practices were adhered to throughout (Gephart, 2004; Kaufmann & Denk, 2011; Suddaby, 2006). Grounded theory is well suited to interactional research (Goulding, 2005) and for researching complex, dynamic social processes in a business context (Flint, Larsson, Gammelgaard, & Mentzer, 2005). The constructivist version of grounded theory was used because of its high relevance to collaboration contexts in which truth is highly subjective and socially constructed.

The context of the study includes but is not limited to SMEs. Selected organisations ranged from small companies to global corporations and regional, national and international collaborations were reviewed, to explore the social processes through which collaborative relationships are formed and developed.

The study was undertaken in two phases. In the preparation and scoping phase, field notes were compiled on collaboration issues observed during 990 hours of direct engagement with six SMEs, as part of a business collaboration and innovation programme, funded by the European Commission. In the second phase, data collection proceeded through open-ended, semi-structured interviews with twenty-nine senior managers/executives from twenty-seven different organisations. An active interview (Holstein & Gubrium, 1995) approach was adopted and open-ended questions were used to "encourage unanticipated statements and stories to emerge" (Charmaz, 2014, p. 65). Interviews typically lasted 1-1.5 hours, were digitally recorded, and fully transcribed to ensure that the respondent voice was accurately represented during initial coding. The interview protocol was revised as the study proceeded, in accordance with the method principles, to focus on emerging topics of interest and to explore categories in progressively greater depth as the analysis progressed through focused coding into theoretical coding (Saldanha, Mello, Knemeyer, & Vijayaraghavan, 2015). Data gathering continued until the properties and dimensions of the core categories were fully established and it was considered that further data gathering would be unlikely to add further insight (Kaufmann & Denk, 2011).

Data analysis

As transcripts and supplementary materials became available they were loaded into NVivo® 10 and coded. Coding and analysis processes followed three stages of coding: initial coding, focused coding and theoretical coding (Charmaz, 2014). Initial coding is a wholly inductive process allocating emergent codes as indicated by the data. In accordance with the study objectives, the focus during initial coding was on identifying action, actors and situations, rather than less insightful passive, descriptive codes (Saldana, 2016). In focused coding the enquiry is narrowed to focus on categories abstracted from the initial codes and it is from this stage that the first-order concepts were established. In the final (theoretical coding) stage the first-order concepts are examined in relation to each other and by a theoretical explanation of the phenomenon sought. Through this abductive process, the second-order concept (Saldana, 2016) of collaborative compatibility was established and presented as interpretive theory (Charmaz, 2014).

In the development of the process typology, reported as a first-order concept, action and process-related initial codes were collated into categories and elaborated during focused coding. Commonalities and differences in situations, activities and outputs were considered when selecting, structuring or reforming the categories. Codes that were not considered to represent social interaction were excluded, whilst duplicate codes were merged. Complex codes that covered more than one fundamental process were deconstructed. The structure and descriptions of sub-categories stabilised as the properties were elaborated during subsequent data gathering. The final structure of the social process category is presented in the findings as a typology, before the details of the second-order concept of collaboration compatibility are presented.

Research rigour was a priority and criteria appropriate to inductive research (Gioia, Corley, & Hamilton, 2013) were adopted to ensure that process validation was not subverted by positivist predilections (Johnson & Duberley, 2015).

Findings

From this study of the social processes underpinning collaboration, a set of eight fundamental categories of collaborative process are recognised that are used across three phases of a relationship. A set of situational and behavioural factors are also identified that moderate the effectiveness of collaboration processes. These elements are presented as first-order concepts (directly traceable into coded data) and depicted in Figure 1. The analysis of inter-relationships between process categories, and the factors that promote or inhibit them, also led to the definition of *collaborative compatibility* as a second order concept (Table 1).

Initial codes (examples)	**First-order concepts**	**Description (of 1st order concepts)**	**Second-order concept**
Allying Anonymising Anticipating Arbitrating Arguing Benchmarking Brokering Consulting Contributing Delivering … Valuing	*Process categories* • Contributing • Learning • Influencing • Problem solving • Exploiting • Socialising • Brokering • Allying	A typology of eight categories of social processes through which all encountered collaborative action can be described (see Table 2)	*Collaborative compatibility:* Personal competences • Skills • Willingness • Risk attitude • Knowledge & experience Social compatibility: • Identity proximity • Shared cognition • Trust Organisational suitability
	Collaboration phases: • Prospecting • Extracting • Leveraging	A temporal dimension defining the phases through which relationships progress	
Trading environment Collaboration forum Collaboration structure Network structure Relationship Relevance of contacts Social setting	*Situational factors* • Formality • Relevance • Social diversity • Cognitive distance	Structural and environmental circumstances impacting effectiveness	
	Behavioural factors	Personal competencies and	

Collaboration skills Individual traits Contacts Stakeholder issues	• Skills • Motivation • Risk orientation	behaviour impacting collaboration processes	
	Outcomes • Benefits • Tangibility • Locus • Extent	Nature of benefits arising from a social process. Locus identifies benefitting actor(s)	

Table 1 - Conceptual development

In the following sections the process categories are presented as a typology in Table 2, and the effect of the situational and behavioural factors is discussed. The second-order (abstract) concept of collaborative compatibility is subsequently presented. The higher explanatory power of second-order concepts is used to explain the preeminent importance of personal and social factors in widening business participation in collaborative relationships.

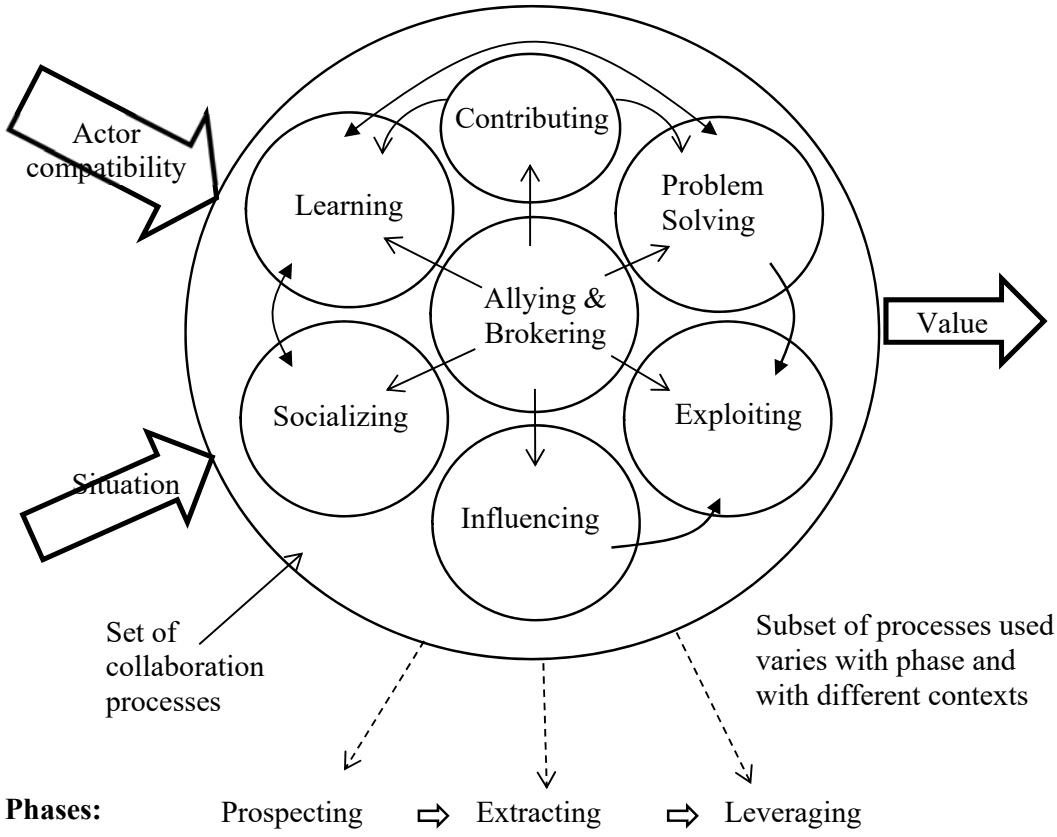

Figure 1: Collaborative social processes

Social processes

A typology of eight categories of collaboration processes (Figure 1) was identified through the analytical aggregation process described in the method. Many of these fundamental processes, described in Table 2, have implications in an innovation context.

Collaborative learning, a cornerstone of innovation, occurs in many forms, including: didactic forums; explicit knowledge media; discursive interaction; site visits; trade shows and during regular commercial interaction. Collaborative influencing bodies (e.g. trade associations) improve innovation potential through political lobbying to affect trading environments, as well as through intra-sector influence to establish and regulate industry specific standards. Problem solving processes are most relevant during the (value) extracting and leveraging phases of collaboration and depend on bonding social capital.

Socialisation processes either, may increase bonding capital associated with existing relationships, aiding knowledge transfer, or enable the development of weak-tie social capital. It is through weak-tie socialisation that firms are most likely to access new contacts and innovative ideas. Examples encountered in this study included the development of a new metal treatment process, arising indirectly from an earlier overseas engagement, and a new business line developed by a steel fabricator, in which a new composite material solution to an existing business problem was identified during a chance social interaction.

Collaboration process	**Description**	**Outputs (org. value and social & human capital)**	**Indicative quotes**
Contributing	Unusual form of collaboration in which one party is contributing knowledge, experience, time or other resources with no immediate expectation of gain. Motivation mainly seems to be repayment of a perceived social debt. Group affiliation may also increase an individual's feeling of indebtedness.	Increased reference value to the donor, with some increases in social capital but most benefits accrue to recipients.	UR "First time I went it was great ... It allowed me to develop a network that really helped me. 18 months later we were the ones presenting … it was a way of putting something back …" [GlobalCo Manager] UK "… I mean / any effective network or association can't just rely on taking out can it, so there has to be putting in …" [SME TD]
Learning	Collaborating with the purpose of acquiring new information, or new knowledge. Examples noted covered: Technical: knowledge of new technology, techniques or new application, acting as a source of innovation; Market: information about competitor proposition, competitive environment; Relational: contacts, access points and opportunities. *Learning* may be an active, purposive process, or passive as a by-product of other collaborative activities.	Individually centred human capital leading to organisational intellectual property when absorbed. Individual social capital also increased during learning.	MS "In the industry it's called stealing with pride … so we'll look at something and … look at introducing something like that in our line". [SME Works Manager] DG "you never know what you're going to pick up from when you walk around a company … you get best practice sharing … things that may spark off ideas for you". [Broker CEO]
Influencing (incl. lobbying & persuading)	*Lobbying* seeks to affect the macro-economic business environment for the benefit of a group. Changes in tax, regulation, investment policy are examples. Change is sought but not guaranteed. *Persuading* is the code used to distinguish collective collaborative effort designed to affect the micro-economic environment, such as through agreeing industry standards. Here influence is exerted on peers and the group potentially has power to effect change.	Vanguards increase social capital, power, reference, and human capital. Organisations benefit from reduced costs and increased market activity where action succeeds, but activists may incur higher costs, motivating others toward freeloading.	QA "the Chief Exec … we've kind of … targeted him to things like opening links with Government and … lobbying activists and things like this … LG "… we have agreed with the World Trade Organisation that when these issues are discussed … at governmental level that we should be involved … An import/export ban … those bans have been lifted quite quickly after we've complained". [Broker CEO]
Problem Solving	*Fixing*, *sourcing*, *solutioning*, exemplify a variety of codes covering design, resourcing and remedial activities that either enable new value streams or stem value losses. The mind-set of creative engineers was a recurrent theme in several interviews.	Group members increase human capital and bonding social capital. Organisations gain intellectual capital, but value timing is variable.	TA "there must be some new technologies that would help us … we would then go out to the market … to come up with ideas …" [UKGov Prog. Manager] QB "We've solved some of our customers' problems … This goes back to having an interest ... Solving problems is an interesting challenge. That's maybe why I do crosswords …" [SME MD]

Exploiting	Collaborative commercial exploitation of an opportunity. Accessing additional resources. Driving revenue and value. Once established, the interaction may persist for an extended period in this 'run' state. It is this state to which much existing literature limits its attention.	Organisationally centred, commercial value	DG "Yes, because it is all about commercialisation. So suddenly the challenge is … do you get others involved, how do we ensure that we're getting … money in to companies locally …" [Broker CEO] TA "You would then work with them … speak to relevant people … then take it to the next stage ..." [UKGov Prog. Manager]
Socialising (incl. Networking)	Social relationship development relating to formation or development of business relationships. Value objective & locus may be vague. Includes *networking*, the process of developing business contacts. *Socialising* is a more general interaction between business contacts in any setting, including private social settings.	Individually located bridging social capital (new contacts) and bonding capital (enhanced existing relationships). Not readily absorbed by firms, so remains located in personal relationships.	ML "… national figures, I've been able to chat to them, when they're a bit more relaxed" [Broker CEO] LE "I've tried different ones [networking forums] … whilst I don't get loads of work from it, I do find it really beneficial. … most people face the same challenges and problems [SME MD]
Brokering	Effecting connections between people and therefore organisations. Provides access to knowledge, funding and other resources. Often undertake by third-party organisations such as trade associations; business development programmes; social enterprises; large organisations promoting innovation into their supply chains. Varies from light-touch introductions to active consortium construction.	Individual leaders of broker organisations develop social capital, power, reference and human capital. Linked individuals also may develop human and social capital. Org benefits are indirect.	ML "It's more brokering … some might be intuitive … I've sort of linked people by e-mail and thought … you'll really get on and have a productive relationship … [for others] it is more sort of planning and positioning" [Broker CEO] DG "because of our contacts, and because we have a good understanding of what each of our member companies are doing, we have the ability to build consortia for whatever type of opportunity ... engaging internationally or nationally" [Broker CEO]
Allying	Connecting process leading to peer alliances, from simple dyads to new associations. Bottom-up aggregation process in contrast to *brokering*. Alliances may be short-term bid collaborations or longer-term associations that may then lead to subsequent lobbying and brokering activity.	Vanguards increase social capital, power, reference, and human capital. Organisations benefit from reduced costs and increased market activity.	QR "… we established the trade association because we've all got this common problem …" [SME MD]

Table 2 - Collaboration process typology

Brokering and allying processes can facilitate each of the other collaboration processes. Proactive brokers particularly, can significantly enhance collaborative interaction, even to the point of building consortia. Brokering actions however, may also inhibit innovation where brokers undertake 'match-making' between similar, rather than dissimilar contacts.

Personal and behavioural factors

Relationship formation was noted in many instances to be limited by personal and behavioural factors. Weak social skills, an unwillingness to socialise widely, and risk aversion, were each noted to compromise severely an individual's potential for developing weak-tie networks or strengthening closer ties. The director of one company described themselves as "not very pushy people". The company had briefly attempted to strengthen forward and backward supply chain relationships but quickly retreated [Phase 1 field notes]. People's perception of their social skills however, was not necessarily indicative of performance. In the case above, negative perceptions of social skill may have contributed to a reluctance to network, but in two other cases, two SME directors, each of whom described themselves as 'unsociable', were clearly very effective networkers.

Situational suitability.

Few interviewees described any particular strategy for establishing new collaborative relationships and many reported negative experiences of networking, either due to their own naivety: "It's a very complicated dynamic which SME's don't always realise …" [Trade association head], or due to poor event organisation: "sometimes you can be invited along to business networking, and it's just shabby … put together with the wrong people and there isn't enough thoughtfulness behind it" [Social enterprise CEO]. Concerns about the perceived suitability of attendees at events led some to seek out those with a similar identity. One SME owner, for instance, identifies himself as an "engineer" and courts "…like-minded engineers and manufacturing people" to collaborate with on new projects and products.

Suitability of interactants is complex. In the first example below an unexpectedly productive conversation occurred at a social event, whereas in the second a professionally organised networking forum was unproductive. At the social event a new marker for use in international cotton regulation was identified during a discussion on problems of authentication, between a banker and a cotton regulator. In the second case however, the marketing director of an ICT company who attended many networking events in the maritime sector lamented: "nobody was interested … we never got a single sale out of it". Their services were potentially of interest to all companies, but maritime company directors had little interest in ICT and little understanding of the issues. In the first instance, despite their different backgrounds, a productive dialogue was established, whereas in the second case common ground was not established.

Collaborative compatibility

Collaborative compatibility is reported as a second-order (abstract) concept that helps to explain how the identified social processes are moderated by behavioural and situational factors. Compatibility is a complex concept that considers ultimately how individuals establish legitimacy in each other's right to participate in collaborative action, and how individuals establish agency in relation to subsequent interaction. The concept is represented (Figure 2) in three dimensions to represent the personal, social and organisational factors that collectively determine the competence, commitment and cohesion with which a collaborative interaction is undertaken.

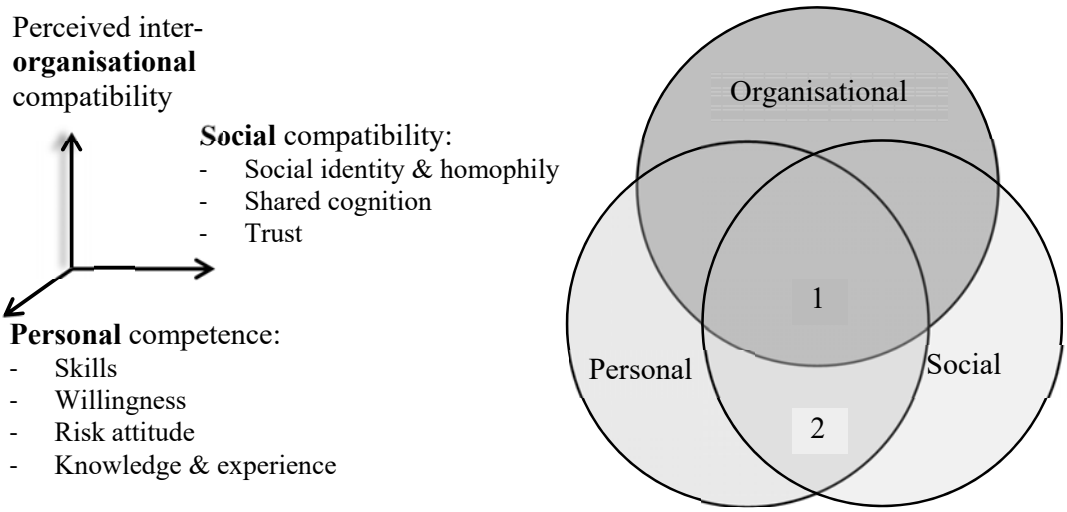

Figure 2- The 3 dimensions of collaborative compatibility

Personal dimension: Firstly, collaboration depends on personal competency and commitment. Individuals must be competent in both the subject matter and in social interaction. Only then will connections be established; social rapport be built, and effective communication established, enabling potential innovations to be identified. Each collaborating individual in a situation must have these skills and be willing to collaborate.

Social dimension: An actor's willingness to collaborate depends on their perception of the legitimacy of that interaction. The potential to interact (agency) is enhanced where social identity, previously established social capital, or newly perceived common cause encourage actors to explore further their collaborative potential.

Organisational dimension: This is a subjective assessment by individual actors that their interaction could lead to commercial value for their respective organisations. It is an assessment of potential suitability that could be a vertical supply-chain relationship or a potential peer-to-peer collaboration.

Collaboration effectiveness is optimised where the greatest congruence occurs between the three dimensions (area 1 in Figure 2). Congruence occurs when two or more competent and socially compatible individuals, representing two or more organisations, are fully committed and empowered to interact. However, collaboration between compatible and competent individuals is also possible when organisational compatibility is not perceived (area 2). Individuals collaborating at industry events and even in social settings are creating value which may by-pass their parent organisations. Conceptually, this is noteworthy because it suggests that of the three dimensions, only organisational compatibility, the unit of analysis for many studies, is optional.

Discussion

The study identifies the basic social processes through which people collaborate and proposes a model, through which, the way personal and social factors affect those processes can be explained. This richer understanding of how people collaborate, especially in the formative stage, will help organisations to identify appropriate collaboration personnel, and help to increase the likelihood of innovation collaborations arising through business networking.

The development of new collaboration relationships, founded on innovation, is complex, being affected by the way people learn, the way they connect, who they connect with, and how competently they forge new social links. Each of these facets may exhibit contrasting forces. The learning literature, through the concepts of absorption capacity and cognitive distance, establishes the benefits of relationships with more distant knowledge sources, but only as far as those ideas remain understandable and accessible (Enkel & Heil, 2014). People need broad, rather than deep knowledge, to engage diverse sources in productive dialogue, to identify relevant new ideas. However, those responsible for developing and exploiting ideas need deeper technical knowledge, and the capability to develop close social relationships.

The way people connect is reflected in their accumulated social capital. In an innovation context, those with extensive weak-tie networks, are much better positioned to access rare and valuable innovation opportunities. Contrastingly, those with strong-tie connections are better positioned to collaborate deeply over an extended period to develop knowledge. Innovation *prospecting* is best performed by relationship managers with broad, rather than deep, human capital, and extensive (and therefore weak) social networks, whereas the exploitation of relationships, once formed, requires people with deeper knowledge and the development of strong-tie relationships. Exploitation resources are most likely to exist in design and/or operations functions, but organisations need to consider where the best prospectors are likely to be situated. In larger organisations, strategic sourcing professionals, with extensive networks of external contacts, are potentially ideally qualified prospectors, but in smaller organisations, only the entrepreneurial heads may have sufficient social and human capital.

The effectiveness of innovation-oriented business networking; the way people connect, is also affected by their social inclinations. The more people have in common, the more inclined they are to interact socially. Homophily (McPherson, Smith-Lovin, & Cook, 2001) describes the natural tendency for those with common traits to aggregate. The SME owner who identifies himself as an "engineer" and courts "like-minded" people to collaborate with on new projects, exhibits homophily and a social identity (Ashforth & Mael, 1989). Such groups benefit from common knowledge and a shared language that facilitates the exchange of complex technical knowledge. However, homophily also runs the risk of closing, rather than widening people's networks, reducing their chances of innovation encounters. Sector based membership organisations, such as trade associations, may therefore constrain their members exposure to radical innovation sources. Networking events need to group people from diverse organisational backgrounds, but who share enough in common to be willing to interact.

The importance of collaborative compatibility

Social compatibility needs to be recognised as having pre-eminence over organisational compatibility. For effective dialogue to occur, individual competences and social compatibility are essential, whereas organisational compatibility acts as an influence on assessments of social compatibility but is not essential; individuals can develop their own business relationships. Potential collaborators need to have the requisite social skills, technical knowledge and motivation to collaborate, yet even the most competent individuals will not form an effective relationship unless social compatibility is established.

Structuration theory (Giddens, 1993) suggests that the power of would-be collaborators to interact (agency), influences, but is also constrained by their social environment (structure). In a business context, both individual and organisational perceptions by each party, of each other party, contribute to this social environment. Each party's judgement of the legitimacy of the interaction will be based on assessments of the other's status and influence, and perceptions of the status and relevance of the organisation they represent. Although competent individuals

influence their environment, ultimately agency is linked to the establishment of shared language, a compatible power-regime and recognition by the other party(ies) of the legitimacy of the interaction (Giddens, 1993). This social compatibility is illustrated by two contrasting examples reported in the findings. In the first, the absence of a common language between an ICT executive and maritime sector businesses, the technical importance was not understood, legitimacy was not established, and relationships failed to develop. In the second, a valued innovation was developed following an initial encounter at a social event in which two individuals, from different business sectors, quickly established a rapport enabling them to discuss common issues from which an innovative application of technology was generated.

Contribution to theory

Collaborations are not all equally effective (Al-Laham et al., 2010) and this research contributes to theory with a topology of distinct social processes through which collaboration is undertaken, and identifies behavioural and situational factors that moderate the effectiveness of those processes. This breakdown of collaboration processes then enables the contrasting benefits of the bridging and bonding forms of social capital to be revealed, thereby highlighting the contrasting skillsets required at different stages of relationship development. For the development of new relationships in an innovation context, where the initial social interaction is by necessity with an acquaintance (weak-tie) from a dissimilar organisation, the research reveals a set of personal, social and situational factors through which collaborating parties firstly establish the legitimacy of the interaction and subsequently establish an effective dialogue. These factors are collated in an abstract model of collaborative compatibility that complements and extends recent work on personal collaboration motivation (Schillebeeckx et al., 2016), by highlighting the pre-eminent importance of the personal and social dimensions of collaborative compatibility, without which inter-organisational potential would not be identified or realised.

Practical implications:

The collaborative compatibility model has implications for how organisations plan and execute B2B collaboration. Organisations need to consider that the personal attributes, experience, social status and accumulated social capital will all affect the efficacy with which innovation potential is realised. Strategic sourcing managers (SSMs) with extensive industry contacts (weak-tie networks), are well placed to identify new sources of innovation, at the prospecting phase of relationships, whereas supplier relationship managers (SRMs) and technical experts, with fewer but more closely-bonded relationships, are suited to exploiting innovation potential but would be less effective in a scouting role. Given that the greatest innovation potential lies in more distant relationships, SSMs need to establish links outside their established sector supply-chain network, by engaging similar firms that work in other sectors, or firms with synergistic capabilities but with products and services that contrast with those of established suppliers. Innovation in existing products and services may arise through this broadened supply-chain perspective, whilst new products and services may arise through horizontal as well as vertical collaboration. Organisations need therefore to consider which roles are best suited to innovation sourcing, and SSMs, with broad subject-area knowledge and extensive business networks, may be particularly well positioned to fulfil this role through both horizontal and vertical relationships.

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Institutionalizing deliberate exploitation of procurement instrument explorations

H.E.C. Plantinga[1], J.T. Voordijk[2] and A.G. Dorée[2]

[1] Procurement Department, ProRail. P.O. box 2038, 3500 GA Utrecht, The Netherlands. Phone: +31 88 231 4787. Henrico.Plantinga@ProRail.nl
[2] Department of Construction Management & Engineering, University of Twente. P.O. box 217, 7500 AE Enschede, The Netherlands. Phone: +31 53 489 4254, Fax: +31 53 489 2511, J.T.Voordijk@utwente.nl, A.G.Doree@utwente.nl.

Summary: Public clients both drive and face ongoing changes in the instruments used to procure supplies, works and services. Keeping an appropriate balance between exploitation of extant procurement instruments and exploration of new instruments is a challenge, as general problems, such as the stickiness of knowledge, scarcity of resources and the project based character of multi-project clients impede effective exploitation. This paper reports on an Action Research approach to further develop this exploitation capability in a public client's procurement department. It is concluded that without deliberate efforts to improve the procurement instrument exploitation capability, an efficient and effective reuse of newly developed procurement instruments is likely to remain out of reach.

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Keywords: organizational learning, procurement function, organizational capability.

Submission category: working paper

Introduction

Multi-project public clients generally operate a variety of procurement instruments such as contracts, supplier selection systems and contract award methods. Over time, these procurement instruments change. Changes may be imposed or influenced externally, for instance by changes in tendering legislation, public values or government procurement policy. Changes can also be driven by clients themselves, for instance to achieve more value for money in a complex and demanding project. Either way, new instruments emerge that form necessary substitutions of, or valuable additions to the client's current set of instruments.

Some changes are important but simple, such as updating a contract template's references to a new version of standard terms and conditions. However, other changes involve time consuming and risky development processes, such as the development of a CO2-reduction procurement instrument (e.g. Rietbergen & Blok, 2013) or the application of new types of contractual arrangements such as public-private-partnerships (Liu, Love, Smith, Regan, & Davis, 2014) and project alliancing (Lahdenperä, 2012). To exploit this spectrum of changes to the most, clients need to structurally evaluate the potential added value and select appropriate ways to share knowledge about modified or new instruments throughout the organisation.

However, several barriers, such as the stickiness of knowledge, scarcity of resources and the project based character of multi-project clients, restrain the organizational capability to structurally exploit developments in procurement instruments. Especially for clients employing dozens of procurement officers to run hundreds of tender procedures each year, sustaining and improving this exploitation capability is essential.

Therefore, it is key to identify impediments to the exploitation of procurement instrument developments and understand how these can be overcome. This paper reports on an embedded

case study (Yin, 2014) to improve this capability in a multi-project public client's organization. Action Research (Maestrini, Luzzini, Shani, & Canterino, 2016) is applied to identify and overcome empirical barriers encountered during the improvement efforts.
While the study is not finished yet, results achieved so far indicate that improving the exploitation capability can prevent overlapping work, enhance the efficient and effective reuse of instruments, and facilitate learning. The study also confirms that generally known barriers such as prioritization issues limit this exploitation capability. It is concluded that without deliberate efforts to improve the procurement instrument exploitation capability, an efficient and effective reuse of newly developed procurement instruments is likely to remain out of reach.

Theoretical approach

Organizational capabilities

Capabilities are defined as the knowledge residing in the routines of an organization to integrate and coordinate its specific resources, skills and competencies to perform various activities (Hartmann, Davies, & Frederiksen, 2010; Zollo & Winter, 2002). The specific capability this study hones into is related to, but distinct from contractual capability. Contractually capable public agencies are able to foresee major hazards of opportunism in the transaction relationships and address them *during* the drafting, tendering and negotiating of contract documents (Hartmann et al., 2010). In contrast, this study aims at the capability to structurally consider and facilitate general future exploitation of contract documents and other types of procurement instruments *after* these have been developed (in short: exploitation capability).
We assume that the routines that constitute exploitation capability encompass two main actions. The first action concerns the consideration of the potential reuse of significantly modified or newly developed procurement instruments. If reuse – in whatever form – indeed is considered worthwhile, then the second action becomes relevant: the facilitation of knowledge sharing on the instrument.

Organizational learning

As indicated in the introduction section, the capability examined in this study is perceived as an exploitation-exploration balancing problem (March, 1991). Exploitation and exploration are linked by the consideration to reuse newly developed procurement instruments. Without reuse, the resources spent on instrument development will be returned by a one-off application only. Too much exploration will thus result in inefficient procurement processes. On the other hand, too much exploitation may result in a rigid application of extant procurement instruments that insufficiently address the client's current procurement challenges.
Maintaining an appropriate balance relates to the central topic of organizational learning (March, 1991). Therefore, this study employs the perspective of organizational learning. According to the 4i-framework of (Crossan, Lane, & White, 1999), organizational learning concerns four social and psychological processes: intuiting, interpreting, integrating and institutionalizing. These processes link the assimilation of new learning (exploration) and the use of what has been learned (exploitation) at individual, group and organizational level. Intuiting and interpreting occur at the individual level, interpreting and integrating occur at the group level, and integrating and institutionalizing at organizational level.
Crossan et al. (1999) hold that organizational learning is different from the simple sum of the learning of its members. Although individuals may join or leave an organization, what they have learned does not necessarily leave with them. Some learning is institutionalized, i.e. embedded in the systems, structures, strategy, routines, prescribed practices of the organization, and investments in information systems and infrastructure.
The process of institutionalizing not only embeds learned behaviours that have worked in the past into the routines of the organization. It also feeds back to the group and individual level by

creating a context through which subsequent events and experiences are interpreted (Crossan et al., 1999). It would therefore follow that, for a public client to maintain the capability to deliberately consider and facilitate the exploitation of newly developed procurement instruments, the learning about how to do this must become institutionalized. This means that routines, procedures or diagnostic systems should be created to facilitate feedback to the group and individual level.

Barriers derived from literature

It can be anticipated that several barriers impede the exploitation capability. In the preliminary stage of this study, the following barriers were derived from literature.

Complicated trade-off - Keeping a proper balance between exploitation and exploration is problematic. Literature holds that decision making on the trade-off between exploration and exploitation is complicated by the fact that returns from the two options vary in many respects, that learning on individual and organizational level involves conflicts between short-run and long-run concerns and between gains to individual and collective knowledge, and that exploitation and exploration compete for scarce resources (March, 1991). This general statement is likely applicable on procurement instruments as well.

Fragmented knowledge - Literature on the development of contract templates – which in our study are seen as a particular type of procurement instruments – indicates that contracting knowledge is dispersed throughout the organization (Argyres & Mayer, 2007). This problem of fragmented knowledge is also identified in literature on cross-functional sourcing teams (Driedonks, Gevers, & van Weele, 2014; Moses & Åhlström, 2008). The more fragmented the knowledge about a procurement instrument, the more likely reuse is considered one-sidedly.

Tacit Knowledge – A major stream in literature holds that knowledge transfer relies to a great extent on the storage, retrieval and transfer of explicit knowledge. Knowledge is seen as a continuum between explicit and tacit knowledge (Nonaka & Von Krogh, 2009). The more implicit or embedded knowledge is, the harder it is to share that knowledge. Consequently, the more implicit the knowledge about the design and functioning of a procurement instrument is, the more difficult it is to properly consider and facilitate its reuse.

Barriers to knowledge transfer – Several barriers to knowledge transfer have been reported in construction management literature, such as lack of time and resources to capture lessons learned, lack of usefulness of captured knowledge, focus on failures, lack of purpose, and lacking commitment of staff and management to knowledge sharing initiatives (Hartmann & Dorée, 2015). In addition, employees may resist knowledge sharing because of fear to lose their unique value for the organization and thus reduce chances of promotion. This resistance may be amplified by the organization's lack of recognition or reward for knowledge sharing (Ragab & Arisha, 2013).

Limitations to knowledge sharing strategies – The three main knowledge sharing strategies of codification, personalisation and people finder each has its limitations (Ragab & Arisha, 2013). For instance, codification requires time to write out knowledge and reading by others, while the more tacit aspects of the knowledge base will not be transferred.

Project-based organizations - Project based organizations seem to be caught up in the learning paradox of projects. Due to their fluid, temporary and interdisciplinary nature, projects are both seen as stimulating learning and the creation of knowledge, and as restricting the assimilation of created knowledge by other organizational units (Hartmann & Dorée, 2015).

Research design

The study is performed at the procurement department of a high-outsourcing, multi-project public infrastructure management organization. While this department had procedures in place for maintaining a portfolio of procurement instruments, there were indications that newly

developed procurement instruments could be reused more effectively. The research was therefore designed to assess and improve the organisation's exploitation capability.
According to organizational learning theory, once a sequence of actions has become an organizational routine, it will facilitate feedback to the group level and individual level. Having established an exploitation routine in the client's organization is therefore the desired end state that this study should contribute to.
The aim was to design an effective procedure for considering and facilitating the future reuse of newly developed procurement instruments, and incorporate it in the client's Quality Management System (QMS). Once part of the QMS, it will help both individuals (such as procurement officers, category managers, and cost engineers), and groups (procurement teams, project teams, cross-functional sourcing teams) to consider the potential added value of reusing recently developed procurement instruments. However, for the procedure to be actually used, it should also be embraced by management and staff. It was therefore anticipated that supportive actions would also be needed to stimulate the procedure's use.
Since this approach implies making interventions in practice, Action Research (Maestrini et al., 2016) is applied. In the PSM research community, Action Research (AR) has been identified as highly appropriate for public procurement because of its complex, practical and dynamically changing nature (Walker, Harland, Knight, Uden and Forrest, 2008). In particular, AR is often used to address practical implementation challenges (Walker et al., 2008).
The research is divided into a preliminary phase and three main phases. It was decided to first assess the as-is situation (preliminary phase), before developing a procedure design (phase 1), improve it by testing it in practice on a procurement instrument (phase 2), and finally get it incorporated in the client's QMS (phase 3). It was anticipated that along the way towards achieving an organizational routine, the learning processes of intuiting, interpreting, integrating and institutionalizing could lead to the identification of additional barriers. In turn, solutions to cope with these barriers could lead to procedure improvements and supportive actions (see figure 1).

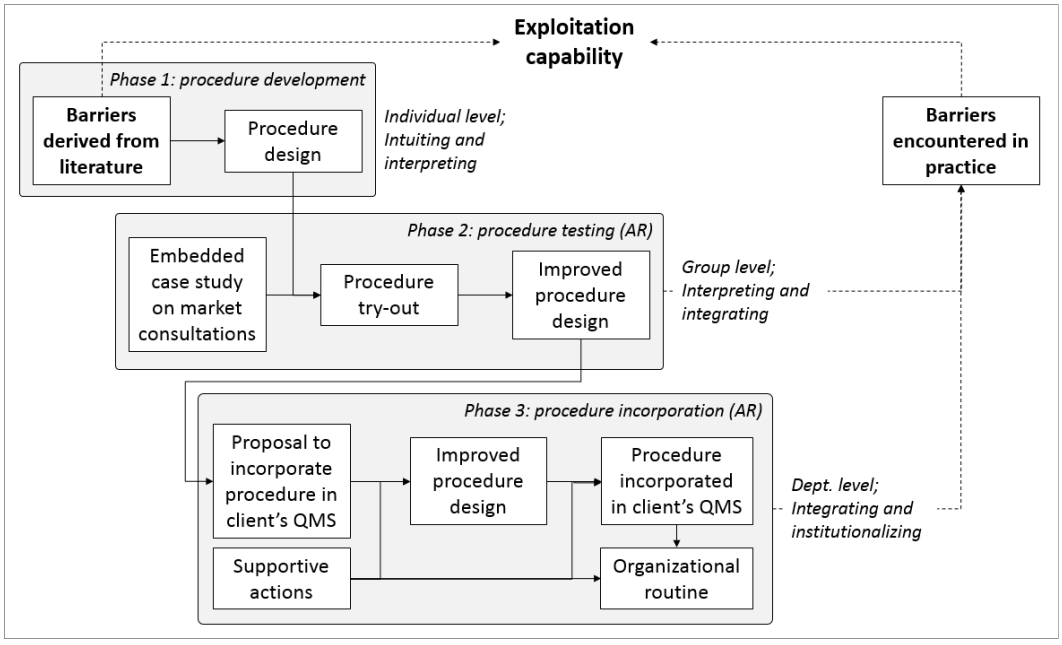

Figure 1: Research design

Both to create more in-depth insight in the way processes were run in the client's organization, and to serve as input for testing the procedure design, phase 2 includes an embedded case study.

The case concerned the client's use of documentation to run market consultations. This case was selected, since there were indications that the number of applications had been growing extensively. However, while standardisation had been proposed once, as yet no document template had been created. Anticipating that developing a template for this instrument indeed would be the desired outcome, this case would allow for running the procedure in its most extensive form. The case also seemed appropriate because it concerns a fairly uncomplicated instrument, and would thus not draw off too much attention from testing the procedure.

Results

The following sections present the results of research phases. Given the purpose of this paper, the identification of, and dealing with barriers in each phase is brought to the fore.

Preliminary phase: as-is situation assessment

The overall perception of the as-is situation was first checked by a fact finding effort. The fact finding involved several activities, such as scanning the client's quality management system (QMS) for relevant texts (e.g. that describe *how* to consider potential future reuse of newly developed procurement instruments, or state *that* reuse should be considered), interviewing procurement officers, and searching project archives for relevant examples of frequently reoccurring procurement instruments that are nonetheless not included in the portfolio. Practitioners raised several issues, such as limited sharing of knowledge on new developed instruments at department level, no long term vision on procurement instrument development, low priority for template development in certain procurement categories, and having no procedure present in the department's QMS that addresses template development. The final conclusion was therefore that the processes run to consider the potential future reuse of newly developed procurement instruments were at an 'initial state' process maturity level (De Bruin & Rosemann, 2005). Consequently, it was deemed worthwhile to attempt to improve the client's exploitation capability.

Phase 1: Procedure design

The procedure design describes how to run a sequence of actions that essentially results in two main outcomes: a) the decision to reuse, reconfigure or retire the instrument, and b) the selection of the most appropriate knowledge management strategy. Figure 2 shows in more detail which steps the procedure design entails. Procurement officers are the main actors in this procedure.
Each step in the procedure design comes forth from the literature on barriers. While some steps may be evident, others are less so. The following texts shortly illustrate a selection of main problems the procedure design is meant to deal with.

- *Instrument identification problems* – Procedure step 1 checks whether a (re-)developed procurement instrument represents a potential addition to the client's portfolio of instruments. This involves identification of the main features of the instrument and comparison with what is already there in the portfolio. Since instruments may show close resemblance, identification may be evident in certain cases, but difficult in others. The concepts of an 'ideal type' (Weber, 2009) and a 'Wittgenstein family-resemblance' (Yeung, Chan, & Chan, 2007) can be helpful to distinguish the instrument from similar instruments.
- *Tacit knowledge* – Procedure step 2 develops a trade-off between exploitation opportunities and costs. However, to assess the instrument's potential value for general exploitation, one first has to know how it 'works'. This is requisite input for assessing how often it may be reused, and how it may strategically align with higher level strategies. Both require adequate knowledge that in part may be tacit (Polanyi, 1966). Literature holds that communicating, in the sense of interpreting and integrating, helps to convert tacit knowledge into explicit

knowledge (Crossan et al., 1999; Nonaka & Takeuchi, 1995). Similarly, causal mapping (Bryson, Ackermann, Eden, & Finn, 2004) is held to facilitate knowledge conversion (Ambrosini & Bowman, 2001).

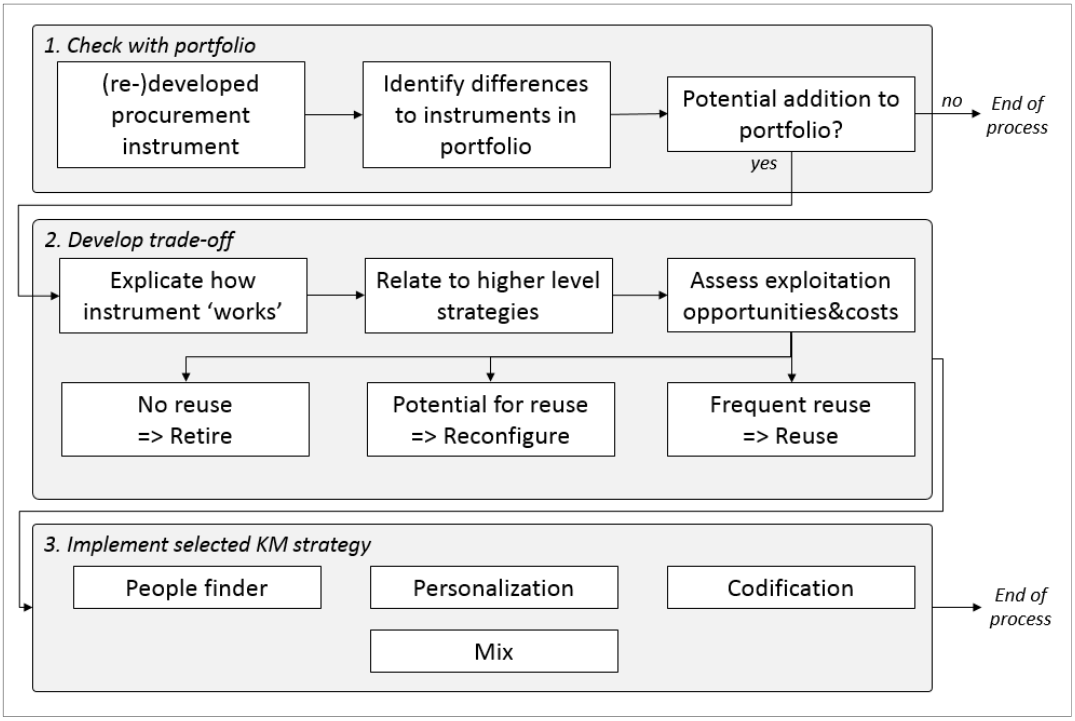

Figure 2: Procedure design (simplified)

- *Complicated trade-offs* – To decide for reuse, reconfiguration or retirement of the instrument in procedure step 2, the *added* value compared to similar instruments (if any) in the portfolio needs to be assessed. Also, if reuse seems preferable, one has to trade off the estimated impact on resources associated with the correspondingly required knowledge management strategy and the estimated returns in terms of future reuse (efficiency) or contribution to higher level strategy (effectivity). This assessment can be complicated by lacking insight into needs of other procurement categories and the content of other category or higher level strategies.
- *Project management issues* – Procedure step 3 concerns the follow-up on the decision to implement a certain knowledge management strategy. However, implementation can become a project in its own right. For instance, if reuse by applying a codification strategy is decided for, then the development of a procurement instrument standard (e.g. a document template plus manual) may face competition for scarce resources, risks and conflicting interests of stakeholders.

Phase 2: Procedure testing

This phase includes the embedded case study on market consultations, which is input to the subsequent first AR-cycle.

Embedded case study results - By searching the project archives for applications of market consultations over the past ten years, the incidence rate per year, the names of the involved procurement officers and the sources for drafting the documentation were retrieved. It was found that market consultations had been increasingly applied over the years, with the most recent year surpassing over 15 applications. Only few procurement officers had run market consultations more than once. While three distinct documents appeared to have served as root

documents for applications later on, the majority of market consultation documents could not be traced back to one of these informal templates. This indicates overlapping work and hampered learning between projects. Presentation of the results to practitioners led to surprise, confirmation of suspicions, recognition and immediate hypothesizing on the causes for the revealed pattern.

AR cycle 1 – The first AR-cycle was aimed at experiencing in a small group of procurement officers the learning processes of interpretation and integration (Crossan et al., 1999) with regards to the procedure design. A two hour session with six practitioners was organized, in which the procedure design and a graph of the market consultation case results was presented. The practitioners concluded that a standard for market consultations should be created. This standard should consist of a template consultation document and a manual for using that document (i.e. codification strategy). After the session, eight practitioners were involved in setting up the standard, mostly by reviewing draft versions. The first author influenced the development process by defining the desired content and creating deadlines.

Barriers – Several of the anticipated barriers were encountered. However, two barriers stood out. These were scarcity of resources and knowledge explication. The participants were struggling with their individual competitive priorities: attending the meeting (no direct relieve of work pressure) versus skipping this meeting to address urgent business issues. While planned long before, and invitations were accepted, attendance proved rather mediate. Also, while the procedure design was quickly accepted as the logical thing to do, and all agreed on applying a codification strategy, progress afterwards in setting up the standard for market consultations was slow. Although process and actors were agreed upon, the first author almost felt like acting as a project manager to get the standard completed. This all indicates that prioritizing currently is the organization's most prominent challenge.

Also, participants were having difficulties in explicating the reasoning behind the procurement instrument. Hypothesizing about 'how it works' and writing precisely that down to instruct future users of the template, appeared to be the most troublesome part of template creation.

Phase 3: Procedure incorporation

Institutionalizing is the process of ensuring that routinized actions occur, and is enacted by establishing rules and procedures, diagnostic systems and routines (Crossan et al., 1999). The third research phase was therefore aimed at incorporating the procedure design in the client's QMS (AR cycle 2) and setting up diagnostic systems (AR cycle 3). While both are to trigger the learning process of institutionalizing, the learning processes of interpretation and integration were anticipated to come up as well, since each AR cycle involved other groups of practitioners.

AR cycle 2 –To make the procedure fit into the QMS, the procedure design was rewritten to the client's format and improved by several clarifications. Also, a number of minor change proposals to other QMS documents were generated. Finally, a draft policy document illustrating the researcher's view on organizational processes with regards to procurement instruments was created. These documents were reviewed by one practitioner and one scholar. The final versions were submitted to the department's committee responsible for procurement documentation. This action was based on the hypothesis that concrete text proposals would help contrast the current versus desired state ("we make sense of the world through comparison and contrast", (Bryson et al., 2004, p. xx)). In addition, the first author illustrated the logic behind all these documents to the committee via an accompanying memo and a presentation during the meeting.

Barriers – Again, prioritization proved an issue. The committee's meeting schedule allowed for only half an hour to discuss all documents. The concluded to address these topics in next meeting again.

During the next meeting one new barrier came up. This concerned an authority issue. Since the committee members all worked for either the procurement or the legal department, and not for

other functional units, the committee's recently appointed new chairman questioned the committee's authority to decide on contract templates. The standard for market consultations was accepted, since it was considered not to be affected by this issue. However, it was decided not to accept the procedure and the QMS change proposals as yet, but to change the QMS at the moment that this authority issue was solved as well.

AR-cycle 3 – According to (Crossan et al., 1999), ensuring that routinized actions occur also involves the use of diagnostic systems. It was decided to address this point by simply asking management to support and supervise the use of the procedure, before setting up more sophisticated diagnostic systems. For this purpose the third AR cycle was initiated directly after the committee's first meeting in AR cycle 2.

This third AR cycle is not finished yet. It started off with a preparatory meeting with the procurement department's management team. The aim was to convince management of the need to create and sustain exploitation capabilities, and to commit each manager to ensuring that the procedure would be used. To this aim, the first author presented the market consultation case results, the logic behind the procedure and a model for identifying the organisational processes involved in the use of procurement instruments. The first author proposed a future decision moment, clarifying that the committee's acceptance of the change proposals would also require approval and management involvement afterwards to ensure that the procedure's use would develop into an organizational routine.

Barriers – Once again, prioritization proved an issue. The management's meeting schedule allowed for only half an hour. While management accepted the need to improve current exploitation capabilities, the main point raised concerned the question which manager should become primarily responsible. Also, follow up on the meeting was left to the initiative of the first author.

Discussion

While the embedded case study quickly convinced practitioners of the need to more deliberately manage the balance between exploitation and exploration of procurement instruments, the challenge is to operationalize this notion into a concrete set of actions and to subsequently develop that into an organizational routine. Although this study is not finished yet, several barriers to developing the exploitation routine have emerged already. The main barrier encountered so far concerns competitive priorities. This is illustrated by the case study on market consultations, as well as by the efforts to develop and institutionalize the procurement instrument exploitation capability.

As the market consultation case showed, lack of priority to spend time on an effective knowledge management strategy results in outcomes such as overlapping work, hampered learning of procurement instrument applications, and unintentional development processes. In a similar way, a lacking priority to incorporate the procedure design in the QMS and to subsequently turn this into an organisational routine is perceptible in the reaction of practitioners on the interventions so far. While the procedure design itself was received as the straightforward thing to do, incorporation in the QMS is made dependent on solving an adjacent problem first.

Perhaps the lacking priority can be explained by the difficulties to unambiguously quantify the negative effects of a shortcoming exploitation capability, and to appoint a problem owner. The reactions on the market consultation case seem to indicate that this is rather an organisational problem than an individual's problem. Also, since the client's current portfolio of procurement instruments appears to be maintained very well, how big is this problem anyway compared to other pressing issues the department is facing? While several practitioners indicated that the market consultation case probably is one in a series of similar cases, a complete overview is not created by this study. Such an overview may create a more compelling argument than a single

case, but requires significantly more research efforts. This way, the study confirms the general statement that decision making on the trade-off between exploration and exploitation is complicated by the fact that returns from the two options vary in many respects (March, 1991). As yet, other barriers seemed to play a less prominent role. However, these probably will become more pressing once prioritization is solved. Knowledge explication presumably is such a barrier. In the market consultation case, explication of how the instrument works proved a challenge. However, without proper explication, assessing an instrument's potential added value and the corresponding appropriate knowledge sharing strategy becomes complicated. In that case, the procedure's outcomes may be suboptimal.

The authority question raised in the committee's meeting came up as an unexpected barrier. While this probably concerns a one-off issue only that can be solved quickly, the progress in incorporating the procedure design in the QMS is impeded by it.

The study applies the 4i-framework of organizational learning (Crossan et al., 1999) as theoretical lens. This framework is primarily intended to explain strategic renewal through the processes of organizational learning (Crossan, Maurer, & White, 2011). While the exploitation of procurement instrument developments counts as renewal, it is open for debate whether it is also strategic. According to (Crossan et al., 1999), for renewal to be strategic it should encompass the entire organization and it should recognize that the organization operates in an open system, rather than having a solely internal focus. The first criterion seems to be the bottleneck here, since changes in procurement instruments may vary from marginal to radical.

In our view, this does not reduce the value of the 4i-framework for our study. Crossan et al. (1999) state that recognizing and managing the tension between exploitation and exploration are the two critical challenges of renewal, and that is exactly the organizational capability this study is investigating. More concrete, the framework proved helpful in providing guidance for demarcating and running the AR-cycles.

There are however some difficulties in applying the framework for this study. Organizational learning is an ongoing process, whereas this study aims to achieve a concrete end goal. The difference becomes visible in the sense that (Crossan et al., 1999) regard routines, procedures and diagnostic systems both as inputs and outputs of institutionalizing. Instead, in this study, the current exploitation capability is improved by creating a departmental routine. This is the intended end goal, which is to be achieved via the incorporation of a procedure and the setting up of diagnostic systems. This also points at another difficulty. Creating a routine may take a long time and its progress is difficult to measure unambiguously.

Conclusion

This paper investigates barriers to the organizational capability to exploit developments in procurement instruments. So far, prioritization issues emerged as a main barrier. Prioritization issues may be explained by the difficulties to unambiguously quantify the negative effects of a shortcoming exploitation capability, and to appoint a problem owner. Other barriers are anticipated to come up as the study proceeds. Given these barriers, it is concluded that without deliberate efforts to improve the procurement instrument exploitation capability, an efficient and effective reuse of newly developed procurement instruments is likely to remain out of reach.

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Reputational value: how buyer status and supplier awards affect supplier performance

Niels Pulles[1], Jenny Bäckstrand[2], Paul Idling[3] and Oguzhan Akdemir[3]
1 University of Groningen, The Netherlands
2 University of Jönköping, Sweden
3 University of Twente, The Netherlands

Abstract
Not all buying firms receive similar treatment from suppliers. The literature describes supplier value (i.e., the benefits a supplier receives from interacting with a specific customer) as an important determinant for how suppliers differentiate their performance for different buyers. This article adds an examination of reputational value: the benefits a supplier receives from reputational gains of collaborating with a specific buying firm. Contrary to other sources of supplier value, which refer to the benefits that a supplier perceives within a relationship, reputational value refers to the benefits of a supplier outside the relationship with a focal buyer. We examine how two sources of reputational value (i.e., collaborating with a high-status buying firm and winning a supplier award) explain differentiated supplier performance. We do so in a three-stage empirical study combining different methodologies. Implications are discussed.

Introduction
Suppliers differentiate in how they treat their customers. The literature provides several examples of how some buying firms managed to obtain better resources than competitors even though they shared their supply base with these same competitors (Castellucci and Ertug, 2010; Dyer and Hatch, 2006; Pulles et al., 2014; Takeishi, 2002). Within the supply management literature, several concepts specifically address this phenomenon and examine how industrial buyers can become a preferred customer (Hüttinger et al., 2012; Pulles et al., 2016; Schiele et al., 2012) or improve supplier resource mobilization (Ellegaard and Koch, 2012; Villanueva et al., 2012). Indeed, the marketing literature describes how supplier prioritize their customers in an attempt to improve customer loyalty (Wetzel et al., 2014; Wieseke et al., 2014).

A key mechanism that explains differentiated supplier performance is the notion of supplier value (i.e., the benefits a supplier receives from interacting with a specific customer; Ramsay and Wagner, 2009). When a supplier perceives a relationship to be valuable, it is more likely to invest resource in this relationship. This mechanism can be explained from both a social and an economic perspective. The social perspective, builds on a reciprocity rationale: if a supplier perceives a relationship to be valuable, the notion of reciprocity implies that the supplier may feel socially indebted to make relational investments to repay this value (Nyaga et al., 2013). Then, a supplier can be expected to make more relational investments in the valuable relationships compared to less valuable relationships (Pulles et al., 2016; Ramsay and Wagner, 2009). From an economic perspective, it is in the best interest of the supplier to allocate resources to the projects of a valuable buyer. For instance, a supplier might improve performance for a buyer that invests in supplier development projects because higher performance for those buyers are likely to yield more investments. Then, in choosing between buyers, a supplier is most likely to choose the option where the expected benefits will be greater (Griffith et al., 2006).

Many studies have examined how supplier value affects the buyer-supplier relationship (Benton and Maloni, 2005; Krause et al., 2007; Modi and Mabert, 2007; Pulles et al., 2016; Ramsay and Wagner, 2009). However, most of these studies have focused on the relational value that a supplier perceives within a relationship, thereby ignoring the value of supplier's relationship with a specific buyer outside the relationship with this buyer. For instance, an endorsement of a major automobile manufacturer may help a supplier signal capabilities to other potential buyers. Such reputation effects can help the supplier gain business outside the relationship with this automobile manufacturer (Kang et al., 2009). Similar to value *within* the relationship, value that a supplier can use *outside* the relationship can incentivize the supplier to invest in the relationship with the focal buyer (Brito and Miguel, 2017; Tanskanen and Aminoff, 2015).

This article examines the effects of reputational value on supplier performance. Reputational value refers to the benefits a supplier receives from reputational gains of collaborating with a specific buying firm. We examine two sources of reputational value: (1) collaborating with a high-status buying firm and (2) winning a supplier award. We do so in a three-stage empirical study combining different methodologies (Wacker, 1998).

We make three distinct contributions. First, we contribute to the supply management literature examining the mechanisms that explain differentiated supplier performance. Whereas the majority of this literature examines the effects of supplier value within the relationship with a specific buyer, we add the notion of reputational value, which is a type of value that enables the supplier to gain benefits outside the relationship with this buyer. Second, we contribute an examination of the effects of buyer status on supplier performance. Although other studies have examined the effects of status on inter-firm interactions (Kang et al., 2009; Mayer, 2006), an examination on the effects of buyer status on dimensions central to a firm's supply management function is lacking. Third, this article contributes by explicitly examining the impact of supplier awards on supplier performance. Although supplier awards programs have become common practice, we know little about their effects relational effects of supplier awards. An emerging body of empirical literature on employee and CEO awards suggest that awards can have a significant effect on employee behavior (Gallus and Frey, 2016; Shi et al., 2017). However, how these findings relate to inter-firm effects is unknown and the literature on the performance effects of supplier awards is scarce.

Literature background

The concept of organizational reputation refers to a categorization of perceived historical quality and performance (Washington and Zajac, 2005). Because reputation is based on past demonstrations of certain behavior, it provides an indication of expected future behavior (Lin et al., 2009). In this way, a positive reputation signals that a firm has the capabilities to demonstrate high performance. In selecting exchange partners, reputation is an important factor for buyers since it may reduce uncertainty about a supplier's future alliance performance and shift the buyer's focus to the high reputation supplier (Jensen and Roy, 2008). In general, good reputations have strategic value for the firms that possess them, and actions that improve firm reputation have a positive effect on profits over time (Roberts and Dowling, 2002). For industrial suppliers specifically, reputational value can lead to additional turnover since good reputation provide potential buyers with a positive expectation of the supplier's capabilities.

Reputational effects of high-status partners

Being associated with high-status partners positively reflects on suppliers. Relationships with prominent organizations conveys that a supplier has earned positive evaluations from influential and experienced actors (Stuart et al., 1999). This positively affects the supplier since other buyers often trust the judgements of high-status buyers and imitate the choices of the high-status buyer. Suppliers are often aware of this and may actively seek collaboration with high-status buyers. High status of a buyer may spill over to a supplier, which incentivizes the supplier to invest in the relationship with the high-status buyer. In fact, if the value of a status spillover is large enough, the supplier might make investments that are not justified by the value of the relationship itself. Kang et al. (2009) discuss how suppliers are willing to make unilateral investments in relationships with high-status buyers, because the reputation effects of being classified as a top-tier supplier will lead to strategic advantages in dealing with other buyers. In this way, relationships with high-status buyers positively affects the competitiveness of suppliers (Stuart et al., 1999). Because suppliers realize this, they are more willing to make investments in relationships with high-status buyers as compared to low-status buyers (Castellucci and Ertug, 2010; Kang et al., 2009).

Reputational effects of supplier awards

In many industries, supplier award programs have become common practice. Awards can be seen as nonfinancial incentives, whose value reside primarily in public recognition (Gallus and Frey, 2016). For the supplier, receiving an award may help in terms of press coverage, improved reputation and increased transactions of the awarding buyer (Beer et al., 2017). Receiving an award positively affects a supplier's reputation as it signals a "best amongst peers" valuation. Awards can serve as quality indicator for buyers because supplier awards predict future performance of the supplier (Azadegan and Pai, 2008; Hendricks and Singhal, 2001).

From the buyer's perspective, supplier awards programs appear to be a low-cost and effective means to recognize supplier efforts and to strengthen the relationship between the firms. In addition, because of the reputational value of such awards, suppliers can be expected to improve performance to win the award. However, the effects of awards may be more complex. For instance, within the relationship, an award can signal that the supplier is of strategic value for the buyer, which can lead to opportunistic behavior. In addition, suppliers that do not win the award can become demotivated and show less commitment to the relationship. Gallus and Frey (2016) argue that the risk of demotivation is especially high in case of confirmatory awards with high ex ante performance criteria on a limited range of dimensions because many subjects may feel they have no chance of winning and give up. Deci et al. (1999) support this notion and show that winners might decrease in performance after winning an award due to unintended motivational effects. These studies were however conducted on an employee level. On a firm-level, there are studies both supporting the moderating effect of supplier awards on supplier performance (e.g., Fynes et al., 2008) and studies that have found that awards, such as ISO 9000 certification, did not have a positive effect on overall quality performance (e.g., Terziovski et al., 1997). Other studies have integrated the concept into broader relational constructs such as communication or evaluation (Klassen and Vachon, 2009; Wagner, 2006) or recommend supplier awards as best practice to motivate suppliers (Krause et al., 2007; Trent and Monczka, 1999). However, the exact effects of supplier awards, on supplier performance of the awarding buying firm are under examined.

Study 1

Experimental design

Study 1 examines the effects of buyer status on supplier performance dimensions. We draw on a scenario-based experiment using descriptive vignettes. Such an experiment uses varying versions of a descriptive vignette to convey scripted information about specific factors of interest to participants (Rungtusanatham et al., 2011). We followed the vignette design stages by Rungtusanatham et al. (2011) in developing and pre-testing our vignettes, including a pre-test by 25 student participants. Our final sample consisted of 105 students at universities in the Netherlands and Sweden. Of these, 43% were female and 57% male with an average age of 23 years. The main nationalities of the participants were Swedish (52%), Dutch (19%) and German (10%).

Our vignettes introduced PintBoards Electronics, a leading supplier of printed circuit boards in Europe, of which the participants were instructed to take the role of CEO. It described how PrintBoards has been a supplier for a leading manufacturer of systems for power generation and transmission for over 10 years. We manipulated the status of this manufacturer. In half of the vignettes, Siemens was the buyer that was introduced as an internationally recognized exemplar firm. The other vignettes describe Lithograph as the buyer that was described to be not an exemplar firm. Participants were randomly assigned to these treatment conditions.

Manipulation checks

As suggested by Bachrach and Bendoly (2011), three separate treatment checks were conducted to assess whether the applied manipulations were effective in creating the specific context of interest. Appendix A shows the items of these treatment checks.

First, we tested if the participants responded as planned to our manipulations. To assess the manipulation of buyer status, we used two items that asked whether the participants considered the buyer to be perceived as high-status and admirable among its peers. The high-status buyer scored significantly higher on these dimensions than the low-status buyer ($mean_{high\text{-}status} = 4.32$, $mean_{low\text{-}status} = 2.23$, $p < 0.01$). From this test we conclude that our manipulations were successful. Second, we conducted Hawthorne checks, using items that are not relevant to our factors of interest but included for the purpose to test extraneous perceptual effects of the manipulations. We included two items on the innovativeness and relational capabilities of PrintBoards. The averaged scores for these items did not show any significant differences between the winner versus non-winner and high versus low-status groups ($p > 0.1$). Therefore, the Hawthorne check indicates that our manipulations did not affect factors and projections other than the intended manipulation factors. Third, we assessed the realism of the scenarios. The participants evaluated two items about the realism and the likelihood of the scenario occurring in real-life. The mean score across these items was 3.74 on a 5-points scale, which indicates a realistic scenario and is comparable to other scenario-based experiments (e.g., Chen et al., 2016).

Dependent variables

We examined the influence of buyer status on two factors important for many buying firms: pricing and resource allocation towards the buyer's projects. To examine the impact of the manipulation factors on price, the scenario described how two weeks ago the buying firm discussed a new project that could result in annual orders of around 200,000 products. The vignette described that PrintBoards indicated that it could sell the components for around €10. However, PrintBoards also indicated that the final price could be either 10% higher or 10%

lower, depending on final calculations. The participants would then read that two weeks later, after long discussions with PrintBoards engineers, they were certain that PrintBoards could produce the components for a cost price €8.50 each and that common margins within the industry are 15-20%. We then asked which price per product (between €8.00 and €12.00) they would offer the buyer.

To examine supplier resource allocation, the scenario described that, in addition to the annual order of 2000,000 products, the buyer was developing a new product for which it needed high-quality print boards. Therefore, the buyer invited PrintBoards to join the development team. The scenario described that, although these projects always involve risk and initial investments, PrintBoards expected the project to be profitable. We then asked the participants to assess PrintBoards' willingness to invest company's prime resources (i.e., best engineers, best ideas, substantial innovation resources; Pulles et al., 2014).

Results

The results show a consistent positive effect of buyer status on supplier pricing and resource allocation towards the buyer. Comparative tests show that the pricing of the scenarios with a high-status buyer show significantly lower prices (i.e., better for the buyer) than the pricing in the scenarios with the low-status buyer ($mean_{high\text{-}status}$ = €10.22, $mean_{low\text{-}status}$= €10.42, $p < 0.10$[1]). For supplier resource allocation, the high-status buyer also scored significantly better than the low-status buyer ($mean_{high\text{-}status}$ = 3.67, $mean_{low\text{-}status}$= 3.40, $p < 0.10$).

Study 2

The results of study 1 show a positive effect of buyer status on supplier performance. Study 2 builds on this finding and adds supplier award as a factor of reputational value. To test the effect of supplier awards, we conducted the same experiment as in study 1, but this time with a supplier award program.

Experimental design and manipulation check

For study 2, we used a similar sample as in study 1. Our final sample consisted of 99 students from the same universities in the Netherlands and Sweden, but in a different study year than in study 1. Of these participants, 35% were female and 65% male with an average age of 22 years. The main nationalities of the participants were Swedish (34%), Dutch (33%) and German (15%).

As noted, study 2 draws on a similar scenario as study 1. The only difference is that a supplier award section has been added as a manipulation. We varied the vignettes into version where PrintBoards received a "supplier quality award" and versions where PrintBoards' major competitor won the award. We randomly assigned participants to the four (2x2) treatment conditions. Similar as in study 1, our manipulation of buyer status was successful ($mean_{high\text{-}status}$ = 4.25, $mean_{low\text{-}status}$= 2.57, $p < 0.01$). We assessed award winners versus non-winners using two items that measured the extent to which the participants felt publicly appreciated and recognized by the buyer. On a 5-points scale, winners scored significantly higher on these dimensions than non-winners ($mean_{winners}$ = 4.29, $mean_{non\text{-}winners}$ = 3.10, $p < 0.01$). From these tests, we conclude that our manipulations were successful. Again, the Hawthorne checks indicates that our manipulations did not affect factors and projections other than the intended manipulation factors ($p > 0.1$). The realism of the scenarios scored a 3.83.

[1] All reported p-values are two-tailed.

Results

Two-way ANOVA tests were conducted to measure the main and interaction effects of supplier awards and buyer status. First, we examined the effects of these factors on supplier pricing. Award winners offered their buyer a higher (i.e., worse) price than non-winners ($mean_{winners}$ = €10.15, $mean_{non\text{-}winners}$ = €10.00), but the results revealed that this difference is non-significant ($F = 0.76$, $p > 0.10$). Concerning buyer status, participants that supplied the high-status firm offered their buyer a lower (i.e., better) price those who supplied the low-status buyer ($mean_{high\text{-}status}$ = €9.87, $mean_{low\text{-}status}$= €10.29). This result was significant ($F = 4.62$, $p < 0.05$). In addition, the results showed that there appears to be some interaction effect between supplier awards and buyer status for pricing ($F = 2.89$, $p < 0.10$). Interestingly, for low-status buyers, award winners offered better prices than non-winners ($mean_{low\text{-}status\text{-}winners}$ = €10.20, $mean_{low\text{-}status\text{-}non\text{-}winners}$ = €10.36) while for high-status buyers, award winners offered worse prices than non-winners ($mean_{high\text{-}status\text{-}winners}$ = €10.36, $mean_{high\text{-}status\text{-}non\text{-}winners}$ = €9.60).

Second, we examined the effects for supplier resource allocation. Award winners did not give substantially different score on the resource allocation items than non-winners ($mean_{winners}$ = 3.62, $mean_{non\text{-}winners}$ = 3.56) and these results were non-significant ($F = 0.12$, $p > 0.10$). Participants that supplied the high-status buyer scored higher on the resource allocation items than those that supplied the low-status buyer ($mean_{high\text{-}status}$ = 3.75, $mean_{low\text{-}status}$= 3.42). This result was significant ($F = 6.78$, $p < 0.05$). The results showed that there is no interaction effect concerning supplier resource allocation between supplier awards and buyer status ($F = 0.18$, $p > 0.10$).

Comparing study 1 and study 2

Similar to study 1, buyer status has a significant and positive effect on both supplier pricing and supplier resource allocation. The results also indicate that winning a supplier awards has a limited or even negative effect on supplier performance. However, to examine the effects of the reputational value of supplier awards we need compare the results of study 1 and 2. If a supplier award program would have perceived reputational value, it can be expected that the overall pricing and resource allocation of study 2 would be better than in study 1. To test this thesis, we conducted comparative tests on the results of study 1 and 2. The results show that the pricing of the scenarios with a supplier award program is significantly lower (i.e., better for the buyer) than the pricing in the scenarios without the award program ($mean_{awards}$ = €10.07, $mean_{no\text{-}awards}$= €10.32, $p < 0.05$). On the resource allocation measures, the supplier award program appeared to have a small positive but not significant effect ($mean_{awards}$ = 3.59, $mean_{no\text{-}awards}$= 3.54, $p > 0.10$). These results imply an overall positive effect of a supplier award program: compared to the scenario without a supplier award program, the prices are significantly better.

Stage two: Multiple case study

The experimental study showed a clear effect of buyer status on both pricing and supplier resource allocation. In addition, a supplier award program appeared to positively influence pricing decisions compared to the scenario without an award program. However, winning versus not winning the supplier award itself did not reveal a clear (i.e., significant effect) effect. Therefore, to further explore the effects of winning a supplier awards on supplier performance, we conducted a multiple case study. In doing so, we distinguish between pre-award performance and post-award performance. In selecting the cases we applied a theoretical sampling approach that follows a replication logic (Yin, 2003). The aim was to

select cases to fill theoretical categories (Eisenhardt, 1989) of winners versus non-winners with low and high-status awardees.

Sample and data collection

We searched for cases on the internet using search terms such as "supplier award" or "supplier award nominees". Suppliers that were mentioned as nominees or winners were then contacted via an e-mail in which we explained our research objectives. At suppliers that agreed with an interview, we aimed to interview the key informant (i.e., the person most knowledgeable on the effects of supplier award). In addition, we interviewed two award issuers. Table 1 provides the descriptives of the selected cases.

Table 1. Cases

Case	Industry	Country	Revenue recipient (mln. €)	Revenue issuer (mln. €)	Perceived status of issuer	Informant
Recipient1	Food	Germany	3	145	Average	Owner
Recipient2	Machinery	Germany	35	1,800	Average	Head of sales
Recipient3	Rail industry	Netherlands	25	1,000	High	Business consultant
Recipient4	Machinery	Netherlands	50	3,000	High	CEO
Recipient5	Logistics	Germany	56	3,900	High	Head of marketing
Recipient6	Recruitment	Netherlands	70	20,000	Very high	BU manager
Recipient7	Telecom	Germany	70	41,000	Very high	CPO
Recipient8	Automotive	Germany	488	153,000	Very high	Managing director
Recipient9	Agriculture	Australia	500	--	Very high	Head of sales
Recipient10	Machinery	Sweden	--	--	Very high	Key accountant
Non-recipient1	Machinery	Germany	10	3,900	High	Owner
Non-recipient2	Machinery	Germany	15	3,770	High	Owner
Non-recipient3*	Rail industry	Netherlands	30	1,000	High	Business consultant
Non-recipient4*	Security	Netherlands	400	1,000	High	Solutions devel. mgr.
Non-recipient5*	Rail industry	Netherlands	2,400	1,000	High	Business consultant
Issuer1	Food	Germany		145		CPO
Issuer2	Machinery	Netherlands		3,000		CPO

*= Non-recipient 3-5 were nominated by the same issuer, but in different award categories.

The interviews were conducted either at the case company's premises or via Skype with an average of 30 minutes per interview. This stage of the study relied on a semi-structured interview protocol. We followed the suggestion of Galletta (2013) who proposed to structure the interview into three segments: (1) the early part of the interview, questions are open-ended to create space for the informants to narrate their experiences, (2) the middle segment is designed to pursue pre-defined topics in more depth and (3) the final segment offers the opportunity to return to earlier discussions and remaining topics that are still open. The interviews were conducted in the interviewees' native language and all interviews were recorded and transcribed.

Data coding

To structure our qualitative analysis, we used a coding scheme to structure the data. Table 2 shows the main categories and includes example quotes in that category. The performance, resource allocation and relationship categories were added to examine performance effects of

supplier awards. Status was added to examine the effects of perceived status of the issuing buying firm. Motivation, dependence and emotions were added based on findings from previous studies on employee awards. For instance, Gallus and Frey (2016) and Deci et al. (Deci et al., 1999) argue that (de)motivation is important in explaining performance effects of supplier awards. In addition, awards might signal dependence of the buyer on the supplier, which can influence negotiations and pricing decisions.

Table 2. Coding categories

Category	Observation (Code set if…)	Example quote
Pre/Post- award Performance	…performance changes, which link to the award itself, occurred prior or post award.	"The award is a driver to perform better […]."
Pre/Post- award Resource Allocation	… supplier resource allocation behavior was reported.	"Returning the favor should be searched in future collaboration and preferential resources. This is what exactly happened."
Pre/Post- award Relationship	… award affected business relationship.	"I think in the long- term, we are going to do more business with […]."
Status	… status of issuing firm relates to effects of award.	"If you are going on stage for […], it is of high value and attraction."
Motivation	… an expression of motivation has been observed prior or post award.	"There was no conscious effort to go out to win the award"
Dependency	… changes in dependency perception due to (non-)winning the award were observed.	"Our products are exchangeable, therefore dependency is not bigger."
Emotions	.. the award influenced the emotions of the recipient.	"A little bit of happiness was noticeable."

Results

Table 3 shows a summary of the pre- and post-award effects within the different cases. The effects of an award program on pre-award performance appear to be limited. Non-recipient 5 is the only case that reported an increase in performance with the intensions to win the award: "A supplier award is important. The award is a driver to performance better, so it does work". The other informants all indicated that, although they did feel to performance good for the buyer, the award program itself was not an incentive to improve performance: "Beforehand, it was not important, but afterwards it was. Initially, we were not concerned with [the award]" (recipient 6); "Besides our daily work in which we deliver good performance, we did not do anything special" (recipient 8).

Awards appear to have more effect on the post-award performance. Four recipients did report a positive post-award effect: "The key product that we supply to them has a very short peak season […]. So, we decided to perform better in non-peak seasons and try to supply as much as we could in order to fill up the stocks." (recipient 9); "[…] we always try to create some degree of value you know. And because of this nice gesture, I mean because of the supplier award, I definitely felt like I should return the favor in thinking more with the customer in meeting their needs and to excel in that. We will try to keep it up for the next time" (recipient 4). Five recipients did not increase performance, mostly because they indicated that performance was already at a high level. For instance, recipient 5 indicated that "At the

moment it is not foreseeable that we perform better because we are already doing very good". In general, the non-recipients were happy to be nominated and not frustrated about not winning: "We are a small firm. It is nice be nominated at all" (non-recipient 1); "It is a pity that we did not win the award. Nevertheless, it is not possible for us to change our services. We perform as best we can and we continue to try […]"(non-recipient 2).). One recipient reported on a decrease in performance after the award "I woke up, literary the day after the award ceremony, and had tree missed calls since our delivery performance was affecting the customers' productivity. This was of course not connected to the award, but it was really embarrassing." (recipient 10). Only non-recipient 5 expressed frustration: "I found it annoying and frustrating that we did not win it. I think the winner in my eyes is not a legitimate winner. The jury was also very vague in their answers. We did not get feedback why we did not win it. […] But, OK, fine there was no reward so let's forget about it."

Table 3. Case summary

Case	Pre-award performance	Post-award performance	Negative effects
Recipient1	High, but not due to the award: slight preferential treatment in product innovation	Similar to pre-award performance	
Recipient2	High, but not due to the award: low prices	Similar to pre-award, increase in motivation but no further improvements	Feels increased dependence of buying firm
Recipient3	High, but not due to the award	Similar to pre-award, already highly committed, no further improvements possible	
Recipient4	High, but not due to the award	Improved, motivation to intensify collaboration and integration initiatives	
Recipient5	High, but not due to the award: capacity allocation	Similar to pre-award, sees award as symbol for strategic partnership; employees are more motivated	
Recipient6	High, but not due to the award	Improved, friendlier relationship and allocated best personnel to buyer's account	
Recipient7	High, but not due to the award: low prices	Similar to pre-award, motivation to intensify relationship	Could take price adjustments into considerations
Recipient8	High, but not due to the award: slight preferential treatment in product innovation	Similar to pre-award performance	
Recipient9	High, but not due to the award	Improved, better performance in non-peak seasons	
Recipient10	High, but not due to the award	Declined, but not due to the award	Feel like they can negotiate "tougher"
Non-recipient1	High, but not due to the award	Similar to pre-award, motivated to intensify projects with the buyer	
Non-recipient2	High, but not due to the award	Similar to pre-award performance	
Non-recipient3	High, but not due to the award	Similar to pre-award performance	
Non-recipient4	High, but not due to the award	Similar to pre-award performance	
Non-recipient5	High, because of the award	Similar to pre-award performance, but motivated to win because of the perceived value of the award	Frustration because award was not won

Almost none of the cases showed effects that could potentially hurt the awards issuer. After being asked, some informants discussed how the award could increase the issuer's

dependence on the recipient firm. Recipient 7 explained: "[…] I would partly say that the dependency has increased a bit by the award […] contracts are fixed for 5 years and the prices as well. But over time, of course, we will also be thinking strategically, to position ourselves differently. This is quite clear. However, it is simply so that you cannot overdo this." Recipient 2: "To use the award opportunistically, we are simply interchangeable. Of course, it would give [issuer] bad press, when it turns out that an award winner suddenly loses the bid and is thrown out. That will not happen. And that is why there is an emotional dependence." Recipient 10 reported on better self-confidence in price negotiations with the issuer "You know, when you negotiate with their French purchasers, their culture is to scream at us and tell us how lousy we are. It doesn't stick the same way after we have been globally recognized as with the award"

Although the cases do not have a great diversity in terms of status, the results do seem to indicate that status of the award issuer does influence the perceived value of the award. For instance, non-recipient 5 explained: "The nomination is great already. Especially because it is a nomination from such a large firm." Recipient 5 who described the reputation of their customer "top, absolutely top" explained the happiness of winning the award: "at the supplier's day mr. [owner] sent us pictures almost every minute and kept us up-to-date […] we have all been very happy about it and it is of course also emotional and important for the employees who are not directly involved." Finally, recipient 10 noted: "since it is such a high-status customer and since we won the 'over-all performance' award, it really boosted our self-esteem."

Indirect effects of supplier award programs

From the literature we know that awards provide a valuable means for motivation because they increase the recipient's status and social recognition (Shi et al., 2017). This rationale explains the lower prices of study 2 (the supplier base with an award program) compared to study 1 (the supplier base without the award program). Study 3, however, nuances this picture because pre-award performance was not observably higher because of the award program itself. Instead, an increase of performance was mainly observed post-award and this increase in performance appeared to be not directly linked to the award itself. Although the recipients were generally happy with their awards, the improved status of the buyer appears to be not a consequence of the award itself, but rather by the professionalism that a buyer signals by the quality of the award program. Award ceremonies are often part of a "supplier day" where suppliers are invited to the buying firm. At a supplier day, suppliers feel appreciated and taken seriously and a well-organized award program contributes to that perception. It is likely that improved motivation stems from this effect rather than from the value perceptions of the award itself.

Discussion

This article adds an examination of reputational value: the benefits a supplier receives from reputational gains of collaborating with a specific buying firm. Based on an experimental design, study 1 and study 2 found a positive effect of buyer status and supplier award programs on supplier performance dimensions. Buyer status positively influenced decisions on supplier pricing behavior and supplier resource allocation. High-status buyers, compared to low-status buyers, received better price offers and supplier resource allocations. The scenarios with a supplier award program showed significantly better prices than the scenarios without such a program, but not significantly better resource allocations. In addition, study 2 examined differences in performance between award winners and non-winners, but did not

show clear effects. Therefore, study 3 examined the effects of supplier awards on pre- and post-award performance using a multiple case study among supplier winners and non-winners. Suppliers generally indicated that their pre-award performance was high (a statement that was reinforced by their nomination), but that the supplier award program of the buying firm had little to do with that. A larger effect was found in post-award performance. After the award program, several of the recipients indicated to have improved their performance. With few exceptions, negative effects of the award program were not observed. Non-recipients, in general, were not frustrated or disappointed by not winning. Although the buying firms in our sample did not show much variation in status, there is some evidence that status affects the perceived importance of the supplier award. The findings of study 3 imply an overall positive effect of supplier award programs, which is in line with the conclusions from comparing study 1 and 2. However, contrary to the rationale derived from study 2, the effects of supplier award programs in study 3 seem not to stem from motivational effects due to reputational value of the award itself, but because of an increased status of the buyer due to public appreciation and professionally organized award processes.

Implications for the literature and theory

The above findings yield three distinct contributions to the purchasing and supply management literature: First, this study contributes to the literature examining differentiated supplier performance. Specifically, several authors examined supplier value as a mechanism that explains why suppliers treat their customers differently. Examples of supplier value are attractive payment conditions, trust, communication, growth potential, information exchange, buyer commitment (Essig and Amann, 2009; Ghijsen et al., 2010; Hüttinger et al., 2012; Ramsay and Wagner, 2009; Vos et al., 2016). These sources of supplier value have been linked to differentiated supplier performance. For instance, relational trust helps to improve relationship efficiency and thus the relative value a supplier gains from the relationship. Consequently, the supplier might show larger commitment to in the trustworthy partner since this partner is likely to yield larger benefits compared to less trustworthy partners. Similarly, growth potential with a particular buyer might be a reason for the supplier to invest in the relationship since this investment is likely to actually realize the growth potential. Reputational value functions differently. The value of an improved reputation lays not within a more efficient or profitable relationship with the buyer itself. Instead, reputational value helps the supplier generated higher benefits in relationships outside the relationship of the focal buyer. Similar to supplier value within the relationship, reputational value incentivizes suppliers to invest in the relationship. Many of the studies referred above do touch upon different types of supplier value outside the focal relationship and some studies have examined "outside dyad" value in terms of capability spillovers (Brito and Miguel, 2017; Tanskanen and Aminoff, 2015). This article continues on these perspectives and adds reputational value as a new type of supplier value external to the relationship with the focal buyer.

Second, our findings show that buyer status has an important influence on supplier performance. In the strategic management literature, a firm's status and reputation has showed to be a relevant factor in how firms interaction (Castellucci and Ertug, 2010; Lin et al., 2009). However, in the supply management literature, the concept of buyer status received relatively little attention (Kaufmann et al., 2017). Concepts such as competence trust (van der Valk et al., 2016) or preferred customer status (Pulles et al., 2016) are related, but these concepts refer to the supplier's perception within the relationship rather the holistic status of the buying firm in the wider business environment. Given the dominant effects of status in our studies, other

studies should consider integrating status as a contingency in their examination of supply management mechanisms.

Third, this article contributes to the purchasing and supply literature by introducing a topic that remained largely under examined: supplier awards. Supplier awards are much used in practice and are therefore not a trivial concept. In many industries, supplier award programs have become common practice. For instance, Boeing implemented supplier recognition programs to award "who achieve the high performance standards" (Boeing, 2016) and the BMW Group awards suppliers "for their outstanding achievements in innovation and development" (BMW Group, 2016). Previous works on intra-firm employee awards suggest that awards can have a significant effect on firm performance (Gallus and Frey, 2016; Shi et al., 2017). Several supply management authors mention supplier awards as general best practice (e.g., Trent and Monczka, 1999) and argue that supplier awards may stimulate competition among suppliers and motivate suppliers to improve (e.g., Krause and Scannell, 2002). However, how supplier awards influence supplier performance for the buyer remains unclear. Similar to commonly examined mechanisms such as supplier development and knowledge sharing, supplier awards influence the relationship between a buying firm and its suppliers. Therefore, a more explicit examination of the impact of supplier awards on buyer-supplier relationships provides an interesting direction for the purchasing and supply management literature.

Implications for practice

This article yields several implications for practice. For instance, because preferential treatment by suppliers positively relates to buyer performance, buying firms can benefit from offering improved supplier value. The findings in our studies imply that such value does not necessarily have to relate to the relationship with the buying firm itself. Instead, buyers that help the supplier improve its reputation can expect improved commitment and performance in return. By becoming aware of these mechanisms, supply managers can more effectively manage their interactions with suppliers. In addition, an important implication for practice relates to our findings on supplier awards. For the buying firms, supplier awards appear to be a rather low-cost and effective tool in awarding suppliers for good performance. In general, supplier awards foster supplier performance, although subtly. To effectively design a supplier award program, the buying firm should clearly understand purpose of the program. Supplier award programs often serve a secondary, arguably even a primary objective, to enhance the relationship between the buying firm and its supply base. Professionalism of the award program appears to be an important factor here. The quality of the supplier day(s) of which the "award show" is often a part and follow-up meetings with both recipients and non-recipients seem to be an important factor in how the supplier award program is perceived and how it eventually affects the relationship.

Limitations

The findings reported in this study should be interpreted in the light of some limitations. One issue is the use of students in our samples of study 1 and 2. There is a strong justification for using students as subjects when key sample characteristics such as age or experience do not interact with the independent variables being studied (Ribbink and Grimm, 2014; Stevens, 2011). Similar to the results found in our sample, results from previous works indicate that buyer status and awards affect decision makers in a business practitioner sample (Castellucci and Ertug, 2010; Gallus and Frey, 2016). Still, samples consisting of business practitioners would be preferred over student samples in future studies. Another issue is that there are

different types of supplier awards. For instance, Beer et al. (2017) distinguish between public and private awards in which the latter is awarded privately and informally. We focused on public awards where the supplier is praised in public, because our interest in reputational value. Still, because the effects of public and private supplier awards differ (Beer et al., 2017), future research should incorporate these differences when examining the effects of supplier awards. In addition, in some industries and countries, supplier awards are more common than in other industries/countries. It can be argued that the effects of supplier awards differ in environments where they are more common compared to those where they are less common. Previous work in the operations research literature shows that when an award is given too often its prestige is diluted (Gavrila et al., 2005). Our study did not integrate this perspective, but future research could examine how newness of supplier award programs in an industry impact the perceived reputational value. Related, our examination of non-recipients in study 3 included only suppliers that were nominated and not non-recipients that were not nominated. Arguably, non-recipient nominees might differ from non-recipient non-nominees. Future research should consider this. Finally, as in many studies, culture is likely to impact some of the effects reported in this study. The samples in our study mainly reflect Western cultures. Future studies might want to examine the impact of culture on the effects of reputational value more explicitly.

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Appendix A– Treatment checks

Manipulation check: supplier award
Please assess the appreciation of [BUYER]
(from "1 , no, I completely disagree" to "5, yes, I completely agree".)

- [BUYER] appreciates the efforts of PrintBoards Electronics
- [BUYER] recognizes the quality of my firm in public.

Manipulation check: buyer status
Please assess the status of [BUYER]
(from "1 , no, I completely disagree" to "5, yes, I completely agree".)

- Among its peers, [BUYER] is highly admired
- Compared to competitors, [BUYER] is a high-status firm

Hawthorn check
How would you rate…
(from "1, very bad" to "5, very good".)

- … the innovativeness of PrintBoards Electronics?
- … the relational capability of PrintBoards Electronics?

Realism check
Please assess the realism of the case
(from "1, not realistic at all" to "5, very realistic".)

- How realistic is this case?
- How likely would this case occur in real-life?

BUILDING THE CASE FOR SOCIAL IMPACT SUPPLY CHAIN MANAGEMENT: CONCEPTUALIZATION AND RESEARCH AGENDA

Madeleine Pullman
Willamette Industries Professor of Supply Chain Management
Portland State University, P.O. Box 751
Portland, OR, USA 97207
mpullman@pdx.edu

Annachiara Longoni
ESADE Business School
Universitat Ramon Llull, Av Torreblanca 59
Sant Cugat del Valles, Spain
annachiara.longoni@esade.edu

Davide Luzzini
EADA Business School
Carrer d'Aragó, 204, 08011
Barcelona, Spain
dluzzini@eada.edu

Summary: This study builds a conceptualization of social impact supply chain management (SISCM). Our contribution is to consider those socially motivated organizations that lie on the continuum between purely social and purely commercial enterprises. We consider these organizations and managerial issues through the lens of institutional complexity. We propose that for these organizations, specific supply chain factors might differentiate SISCM from traditional supply chain management. And as a result, we offer future research directions that might add clarity to effective SISCM.

Keywords: Social Responsibility, Social Enterprise, Sustainability, Institutional Complexity

Category: Competitive Paper

BUILDING THE CASE FORSOCIAL IMPACT SUPPLY CHAIN MANAGEMENT: CONCEPTUALIZATION AND RESEARCH AGENDA

Introduction

Can businesses really solve social problems? Many are questioning if any firm can manage its supply chain to do this job in a long term sustainable way (Pagell & Shevchenko, 2014). A firm may come up with a treatment for a major disease, a noble social goal, but that firm and its supply chain partners mark that treatment up to exorbitant price levels to meet their shareholder priorities. From cancer and AIDS treatments to remedies for snake bites or bee sting allergies, firms often extract high profits at the expense of the needy patients (Kantarjian, 2015; Lewis, 2015; Woodyard & Layton, 2016). Likewise, many businesses feel that job creation contributes to their community and society but then lay off employees or shutter plants as soon as profitability goals are not met (Moon & Sochacki, 1996). On the other hand, non-profit organizations must depend on external sources of funding such as public money or charity and thus lack financial stability. Increasingly, for-profit businesses are being pressured to take social objectives more seriously not only from consumers but from investors, employees, and social media. Thus, their level of participation in social programs correlates with investor interest, market value and the bottom line (The Economist, December 2017).

Either way, the trade-offs created by social goals and profit motivation rarely create long term sustainable solutions. Firms struggle to both reconcile incompatible prescriptions that arise from multiple logics characterizing their institutional environment, namely a commercial and a social-welfare logic, and implement these prescriptions into viable supply chain management (SCM) approaches. Social enterprises have emerged as a possible answer: they pursue a social goal enabled by an economic activity and manage their supply chain accordingly. For example, Semi Di Libertà, an Italian social enterprise integrates incarcerated prisoners into the production of a high quality artisan beer so that they can be trained and placed in brewery jobs when their prison term finishes (Mapelli, Arena & Strano, 2016). What makes social enterprises interesting is their hybrid nature. They try to provide organizational answers to the social-welfare and the commercial logics characterizing the institutional environment in which they are embedded (Pache and Santos, 2013). While for-profit businesses rely on market activities and non-profits and NGOs that are specifically social mission-oriented rely on contributions from donors, social enterprises are mission-oriented ventures that both compete in the market and address complex social problems (Battilana & Lee 2014). This hybrid nature gives rise to unusual organizational strategies and structures that have increasingly attracted research attention (e.g. Battilana & Lee, 2014), as a social enterprise steps in when public and private organizations fail to provide long term solutions to a social problem.

At the supply chain level, making sense of and responding to both social-welfare and commercial logics is also challenging. However, while we are seeing the emergence of research considering non-governmental organizations (NGO) partnerships in supply chains (Pagell & Wu, 2009; Rodríguez, Giménez, Arenas, & Pagell, 2016), very little research has examined how other types of entities including social enterprises act as focal actors in supply chains to achieve a social goal while being economically viable. In this study, we examine the case of social enterprises that pursue their mission as focal actors and discuss how they can manage their supply chains. We will refer to this focus area as *social impact supply chain management* (SISCM), meaning *how a social enterprise manages its supply chain to fulfil its social mission and achieve economic viability*.

Social Impact Supply Chain Management

Supply chain management can be defined as the "management of a network of relationships within a w and between interdependent organizations and business units" and also "the forward and reverse flow of materials, services, finances and information" (Stock & Boyer 2009, p. 691). For supply chain researchers, a focal firm or organization creates and manages the supply chain but may or may not be the firm that provides the final good or service to the end customer. The focal organizations involved with SISCM, social enterprises, fall under the social entrepreneurship literature, a common "umbrella" under which studies about the formation of organizations addressing a social issue are collected (Battilana & Lee, 2014). Most social enterprise literature neglects supply chain management while, in the supply chain literature, few studies investigate social enterprises and it lacks a framework to study the phenomenon.

In order to understand how social enterprises blend into their supply chain management both commercial and social-welfare logics, we introduce an institutional logics perspective of SISCM. Additionally, we describe different approaches to SISCM that social enterprises adopt when combining commercial and social-welfare logics. Previous literature on social enterprises and institutional logics proposes a continuum between two types: the purely commercial and the purely social (Dees & Elias, 1998). These organizations follow different *institutional logics*, meaning principles that prescribe "how to interpret organizational reality, what constitutes appropriate behavior, and how to succeed" (Thornton, 2004, p. 70). Institutional complexity is the term used in the literature to indicate the presence of multiple and potentially conflicting institutional logics (Greenwood et al., 2011, p. 317). A particular logic may be core to organizational functioning such that it determines the core work tasks; another logic may be accommodated through activities and structures more peripheral to organizational functioning (Meyer & Rowan, 1977). In some cases, multiple institutional logics occur at the core, permeating all work tasks, rather than being split into core and periphery (Pache & Santos, 2013). Besharov and Smith (2014) refer to centrality as the degree to which multiple logics are treated as equally valid and relevant. Since social enterprises answer to multiple logics, we expect that – as focal organizations – they will manage their supply chains differently than for-profit enterprises, where the commercial logic prevails.

SISCM Continuum

We argue that social enterprises adopt different SISCM approaches as a response to multiple institutional logics along a continuum between the purely commercial and purely social types. These SISCM approaches are different from traditional SCM due to its limited capability to address this kind of institutional complexity. We take the perspective of the social enterprise as the focal organization managing its supply chain and the object of analysis is its SISCM approach.

At the extremes of this continuum there will be focal organizations that manage their supply chains through a purely commercial or social-welfare, respectively. The former is structured around the goal to sell products and services on the market to produce an economic surplus that can ultimately be appropriated by owners (Friedland & Alford, 1991); whereas the latter mainly makes products and services available to address social needs (Pache & Santos, 2013). At either end, organizations consciously or unconsciously reject institutional complexity when dealing with SCM decisions in favor of a more simplistic view that privileges a commercial or social-welfare logic. Despite the simplification, some limitations might arise due to this choice. On the one hand, purely commercial SCM might result in a limited scope of social impact; on the other

hand, purely social SCM might result in financial instability depending on the availability of funding. Alternatively, social enterprises that are in the continuum between the purely commercial and purely social extremes manage their supply chains in innovative ways to deliver social good and while protecting their economic viability.

We move beyond traditional SCM dominated by one logic to describe three hybrid approaches to SISCM: Decoupled, Combinatory, and Coupled. These three approaches are neither exhaustive of the potential types nor can we claim that they are mutually exclusive or complete; instead they are a starting point in the discussion of SISCM and how it might be different than traditional SCM. We highlight their specificities in terms of strategies, stakeholder identification and engagement, and relationship management in the supply chain as a response to the institutional complexity generated by the combination of the social and commercial logics. Table 1 and Figure 1 summarize the main characteristics of these approaches.

Decoupled SISCM

We define Decoupled SISCM as a situation characterized by a focal organization in which the one logic is core and the other logic is peripheral. We discuss the situation where the commercial logic is core because this is presently much more common in practice, but we address the situation of the social-welfare logic being core when discussing future research opportunities. Pache and Santos (2013) propose that when an organization is primarily embedded in one logic but operating in a complex institutional environment characterized by both commercial and social-welfare logics, it can decouple its formal structure from its operational structure to reduce logic conflicts. In other words, this means that the organization symbolically endorses practices prescribed by one logic while actually implementing practices promoted by another logic, often one that is more aligned with its organizational goals.

The focal organization adopting the Decoupled SISCM approach might be a firm that identifies business opportunities in an emerging market and designs a product or service to address needs of people living in these areas by establishing a new business or brand. In many of these cases, these enterprises describe themselves as promoters of better living conditions for these people (social-welfare logic), who are indeed seen as potential final customers and consumers (commercial logic). We expect the same decoupling approach to happen in the management of their supply chain. In particular, the focal organization will set up a socio-commercial supply chain, where the commercial logic prevails while formally addressing the social-welfare logic by delivering products or services to people in-need.

Supply chain strategy. As the commercial logic is at the core of the focal organization in Decoupled SISCM, the supply chain strategy will essentially be profit oriented, meaning a way to create value through delivering a product or a service to people in-need. Sodhi and Tang (2016) find that emerging markets present a market opportunity for growth for large fast-moving-consumer-goods and durable goods companies. These enterprises benefit directly from designing a product or a service for these people and selling it to them. Prahalad and Hart (2002) popularized this idea as the Bottom of the Pyramid concept, a proposition that multinational corporations could simultaneously generate profits and make a social contribution through marketing to the poor, the lowest tier of the world's economic pyramid. For example, Unilever produced a small, inexpensive bar of soap which was large enough for washing the face and hands once each day for 10 weeks as part of their Lifebuoy soap brand. Since 2002, the soap has been sold in India and promoted as a way to improve hygiene and prevent diarrhoea. In the first

four years, the promotion campaign reached 80 million people; a more recent goal is to reach 1 billion people. This social goal internally translated into a requirement of doubling of sales in five years. This ultimate goal, in line with the commercial logic, resulted in a series of activities that aimed to increase sales and establish distribution networks in both rural and non-rural areas, where people were richer, to more effectively achieve financial goals (Bartlett, 2017).

However, different from traditional SCM, Decoupled SISCM requires the focal organization to not only establish direct relationships in its supply chain with for-profit organizations but also incorporate social entities that understand the target communities. These social entities have earned the trust and loyalty of local communities that they have assisted during challenging times such as war, natural disaster, or poverty relief. Managing the social side of the supply chain is different not only because poor infrastructure and availability of worker skills can limit the size and scope of business units but because the social entities cannot be seen as exploiting the communities for profit. The operational context is similar to the case of humanitarian logistics, but the objective is not to solve a temporary crisis due to exceptional events but to establish long term profitable operations with social benefit implications. Therefore, the basic conditions for applicability of classic SCM or humanitarian logistics strategies might not apply and a specific strategy may be required.

Stakeholder identification and engagement. Because commercial logic is at the core of Decoupled SISCM, the focal organization prioritizes both shareholders and beneficiaries intended as customers. But, this focal organization will need to identify and engage directly in its supply chain with stakeholders different from traditional for-profit actors to achieve their ultimate commercial intention. They might need to design a product or service specifically for the identified population in collaboration with local authorities or social entities as well as build and coordinate a local supply chain to distribute products or services that might include both profit and non-profit actors, governments and regulators to deliver the product or service. The focal company will see NGOs, governments or social entities as intermediaries to expand their brand into developing markets.

For example, most Unilever Lifebuoy soap customers live in remote rural areas that are difficult to reach through conventional channels. Unilever worked with NGOs, local entities, and governments to create a direct communication campaign specifically designed to raise awareness among India's largely rural and often illiterate population. Companies like Nestlé, SC Johnson, and PepsiCo have redesigned food products, cleaners and insecticides to serve the poor. All required rethinking the distribution and financing side of the equation to include local health organizations for delivery of nutrition education and microfinance organizations for payments and loan infrastructure (Brugmann & Prahalad, 2009; Simanis & Duke, 2014).

Relationship management. In Decoupled SISCM, the commercial logic is dominant in the focal organization with managers trying to replicate the formal and transactional style of its traditional SCM and understand relationships in terms of power-dependence determined by resource ownership. At the same time, when local social actors act as intermediaries between local communities and the focal organization, the latter might face the challenge of forgoing an arm's length relationship management style in favor of more relationalism.

As a consequence, in Decoupled SISCM, the focal organization most likely maintains traditional power-dominated relationships with some stakeholders, such as market players, donors, and governments. However, to gain legitimacy, focal organizations often need the

endorsement and support of social actors for their trust. Social actors like NGOs and local community organizations in developed countries are able to influence their localities because they are trustworthy and usually do not exercise power in coercive or formal ways. The focal organization typically needs their help in managing their relationship with local communities. The enforcement of international certification systems for food commodities, such as Utz or Rainforest Alliance, passes through the engagement of local actors that are not merely standard-takers but become directly involved in the implementation, yet not only via classic hierarchical value chains but via an emergent public space (Vellema & Wjik, 2015).

Combinatory SISC

The second approach we describe is Combinatory SISCM. In this case, the focal actor is characterized by high centrality with both commercial and social-welfare logics at its core. According to the institutional logics literature, organizations reconcile competing logics by enacting a combination of activities drawn from each logic in an attempt to secure endorsement from a wide range of field-level actors (Pache & Santos, 2013). The focal organization in this case could be a NGO or non-profit organization (NPO) moving to be more financially self-supporting through the management of its social activities, a for-profit moving to Benefit (B) corporation status (B Lab, 2018), or a purposefully formed social enterprise, all combining the social-welfare and commercial logics. This combination will be reflected in the supply chain management of the focal organization.

Supply chain strategy. In Combinatory SCM, the focal organization combines, in the same supply chain, actors that mainly adopt a social-welfare logic with actors that mainly adopt a commercial logic, often separated into the downstream or upstream side of their supply chain. For example, when actors adopting the social-welfare logic are on the downstream side, they might employ people-in-need to assemble, distribute, or sell social impact products or services. A popular example of this approach is employed by social enterprises managing the supply chain for solar-products to improve the quality of life for the poor in places like Africa (McKibben, 2017), Haiti (Knuckles, 2016; Bals & Tate, 2017) and India (Sawal et al., 2015). In these countries, the social enterprises work to set up assembly and/or distribution centres and hire locals to market, distribute and install solar products and parts. Another downstream logic example, Vision Spring sells affordable reading glasses to low-income individuals through a network of micro-entrepreneurs in various developing countries; here both the entrepreneurs and eye glass purchasers benefit (Bhattacharya et al., 2010).

Alternatively, when the social-welfare logic actors dominate the upstream side of the supply chain, the focal organization works to include people in need on the supplier side. For example, the social enterprise, Arzu, has the mission of improving the lives of Afghani women so they created an online retail portal to sell traditional and custom designed rugs produced by the women; the social enterprise provides design services to the women and fair prices as well as other social support (Sodhi & Tang, 2016). The social enterprise, CIFEA provides beekeeping training to members of a Tunisian region with high unemployment but favourable agricultural conditions and a unique ecosystem. After members are in full production, CIFEA then collects, distributes, and commercializes the specially branded organic certified honey and hive products (YUNUS, 2018). Depending on which side of the chain the Combinatory SISCM engages in social impact activities, the commercial side of the chain either finances and distributes needed products or services on the supply side for downstream social impact or sells the products or

services to generate economic resources to support the social enterprise activities for the upstream social impact.

The context of the Combinatory SISCM strategy is extremely challenging and unusual compared to traditional SCM strategies. While the focal organization benefits from a broader scope and scale for the distribution of their products (downstream Combinatory) or from unique products and branding opportunities from marginalized group suppliers (upstream Combinatory), they must understand and work with unique SCM challenges such as inadequate infrastructure, novel distribution channels, inadequate training, and different cultural norms around work and financial transactions. Here, the focal organization must actively engage in identifying potential supply chain partners among people in-need, help them to improve or change their products or services to appeal to their customer base, extensively train them in production or distribution skills, manage supply flows in challenging localities, providing information to these partners to operate in the market (Liao & Chen, 2017; Sodhi & Tang, 2011).

Additionally, the focal organization goes beyond just employing the workers. The social impact locations are particularly vulnerable not only to life threatening interferences but disruptions in material, labour, or product availability, incoming and outgoing deliveries, and exporting and importing regulations that are subject to shifting political agendas. Many focal organizations also participate in the targeted social group's communities and interact with community decision makers to understand how they can help improve social conditions.

Stakeholder identification and engagement. The focal organization combines the social-welfare and commercial logics in identifying and engaging with relevant stakeholders. Specifically, they will serve beneficiaries, financers, and customers as distinct groups. In Combinatory SISCM, different stakeholders are targeted as a result of different logics. The social-welfare logic prescribes to identify and engage the people in-need at one side of the supply chain and to collaborate with local social actors to help include people in-need in their supply chains. The commercial logic requires identification and engagement with market players that enable the economic activity. Each type of stakeholder will serve a specific role, either on the social or the commercial side. In this sense, stakeholder identification and engagement is about orchestrating the commercial and social stakeholders to comply with the social mission rather than addressing shareholder needs to achieve optimal financial performance. This will imply the inclusion of new actors and roles in the focal organization's supply chain compared to traditional supply chains.

In both downstream and upstream Combinatory SISCM, the social enterprise will need to identify people in-need to become suppliers and/or distributor or retailers (Sodhi & Tang, 2016). Additionally, it will be crucial to identify partners to support the economic and financial growth of these people (Karnani, 2007). For the solar supply chains mentioned above, the focal social enterprises have identified social impact inventors who then contributed funding to micro-financers and the focal organization to support the development of the supply chain (McKibben, 2017). Generally, the focal organization mobilizes resources and capabilities from better endowed stakeholders to offset other stakeholder's constrained resources (Knuckles, 2016). To accomplish this, the focal organization needs to identify and engage with local entrepreneurs, NPOs, NGOs, and venture capital impact investors for traditional or micro financing consumer loans and supply chain activities.

Relationship management. With social-welfare and commercial logics having high centrality at the core of the focal organization, Combinatory SISCM aims to protect less powerful actors at one tier of the supply chain and therefore tends to establish collaborative, long-term and altruistic relationships locally, while managing formal and transactional relationships with market actors representing for-profit customers/suppliers. The social enterprise connects people in need with market actors integrating the different relationship management styles prescribed by social-welfare and commercial logics.

Instead of having a market player who needs to gain the trust of local and social actors (like in the Decoupled SISCM), we have a social enterprise operating at one tier of the supply chain who is dependent on market entities' economic resources to achieve its social goal. Therefore, the social enterprise experienced in trust-based relationship with people in need, must also operate in a typically power-dominated, market context. Depending on the varying levels of power asymmetries, trust can be more or less difficult to build. As in the Decoupled, Combinatory SISCM which include a powerful supplier or distributor will need to use formalized contracts to compensate for power asymmetries or the powerful buyer can invest in site-specific assets for less powerful partners.

Coupled SISCM

The last approach we describe is Coupled SISCM where the focal organizations operate at the nexus of two different supply chains to address respectively social and commercial activities. We focus on socially-focused Coupled SISCM where the focal organization is a social enterprise in which the social-welfare logic is core and the commercial logic is peripheral. We address the situation of the commercial logic being core when discussing future research opportunities. Unlike the Decoupled SISCM, the coupled market and social chains are bridged by a social enterprise as the coupling agent (Gulati & Puranam, 2009). This coupled fit is also reflected in the management of its supply chain. With a social core, the social enterprise has a main mission to address a social need and an economic activity running in parallel to support this social mission and augment its effectiveness. Each of these parallel supply chains, has suppliers and customers with the focal organization as the connection.

Supply chain strategy. In Coupled SISCM, focal organizations operate separate but consistent supply chain strategies to feed the social one. In the social supply chain, people in-need are the beneficiaries of a transformative social service where the output is a skilled person; the commercial supply chain performs a separate economic activity providing economic resources for the social supply chain so it can continue operating without depending on donations and external funding. The focal organization is the bridge between these two chains.

An example of Coupled SISCM is provided by the case of the Work Integration Social Enterprises (WISEs) and their supply chains. These social enterprises aim to help unemployed people integrate into the workforce and labour markets (Pache & Santos, 2013). They deliver their social mission by hiring unemployed people, those with physical or psychological disabilities and populations excluded by the society such as inmates or migrants, for a limited period of time with the objective of helping them acquire the social and technical skills they need to find a job. Thus, they have a social supply chain in place that allows them to identify people in need to hire and place them in the job market. As they work for the WISE, these people produce products and/or services that are then sold to generate revenue, while also developing the technical skills that they need to obtain stable, long-term employment. Thus, the focal

organization has a commercial supply chain in place to produce the goods and sell them to the market. The WISE will be the focal actor actively connecting the two supply chains and managing contradictions and synergies between the two.

Another example is the UK organization, Redemption Roasters, which aims to train young prisoners in Aylesbury prison as baristas and coffee roasters. By locating their roasting facility and one of their cafes within the prison itself, Redemption teaches prisoner-students all about coffee origins and taste profiles, roasting, and drink-making as a mechanism to help prisoners get jobs after completing their prison terms and reduce recidivism. The costs of shipping raw materials in and out of prison can be as much as three times higher that of a normal commercial site but Redemption covers the training and additional costs from their profits (Lander, 2017). Here the social supply chain consists of prisoners with their future employers as employer-customers of trained coffee experts while the commercial supply chain includes the raw materials upstream, roasting process, and the coffee purchasers as customers.

Stakeholder identification and engagement. Like the previous cases, stakeholders can be identified according to their dominant institutional logic. In other words, for-profit actors can be engaged in the commercial supply chain while social actors are engaged in the social supply chain. However, in Coupled SISCM, it might become difficult to clearly distinguish these stakeholder types and the stakeholders themselves will display a hybridization of logics.

In the examples of WISE or Redemption Roasters, on the social supply chain side, the focal firm will engage with social actors as supplier of potential employees as well as social counselling and training services. Additionally, after their value-added training, the focal actor helps the employee find long-term employment. The focal organization interacts with social entities and other partners involved in the inclusion of these people in the society and in the job market. A WISE restaurant that trains disadvantaged workers will engage with other restaurants and hotels as customers. The firms hiring trainees can be considered as pure market actors that hire personnel from the social enterprise just like from any other channel. However, it is not uncommon that these clients are sensitive to the social mission and treat trainees from the social enterprise differently, helping them well beyond what is expected in a traditional business context. Similarly, in the commercial supply chain of the WISE, suppliers are often selected because of shared social goals with the focal organization and customers are usually sensitive to its social mission. Social enterprises adopting Coupled SISCM look for stakeholders to be part of their supply chain that display both social-welfare and commercial logics and do not just orchestrate them as providers of specific resources but actively involve them as partners of both the social and commercial supply chain, sometimes even delegating crucial tasks for the mission achievement.

Relationship management. The focal organization adopting Coupled SISCM is part of two separate supply chains that adopt different logics, have different scopes and strategies, and thus require different relationship management styles. The focal organization could simply adopt more relationalism in the social supply chain and more traditional arm's length style in the commercial supply chain. However, the focal organization might be capable of finding synergies between the two approaches. That happens when, on the one hand, market-oriented relationships with economic actors are reoccurring, building trust as well as enhancing informal and altruistic relationships. On the other hand, the relational intensity with the social actors becomes more efficient thanks to methods and tools that reduce the transaction costs.

The social enterprise orchestrates two interconnected supply chains creating complex power dynamics. In the supply chain dominated by the social-welfare logic, the shared dedication to a common cause would support trust and informal relationships while potentially generating risks of opportunistic behaviours, contrasting objectives, and inefficiencies. For example, a Spanish social enterprise, Mescladis, trains migrant employees in their restaurant for future placement in other hotels and restaurants. Language barriers and employee country-of-origin custom differences create challenging customer experiences such as order miscommunications and slow service (Longoni, Luzzini & Pullman, 2017). In the commercial supply chain, the relationships between the focal firm and its market customers/suppliers would be subject to power asymmetries. However, market players might be sensitive to the role and mission of the social enterprise and want to be associated with it to enhance their image; they can gradually complement or even substitute traditional power-dependent relationships with trust. This can be seen in the Mescladis restaurant where the hiring hotels and restaurants trust the social enterprise in the hiring relationship and even take migrant trainees with questionable legal status and severe personal problems (Longoni et. al., 2017). Typically, it is up to the social enterprise to act as a catalyst and create the basis for a trusting and cooperative climate between the two supply chains characterized by shared values, synergies and resource exchange, and minimum conflicts.

Future Research in Social Impact Supply Chain Management

We argue that the combination of social-welfare and commercial logics in focal organizations will lead to differences between SISCM and traditional SCM. We expect the institutional complexity derived by the combination of social-welfare and the commercial logics to inform different supply chain strategies, stakeholder identification and engagement, and relationship management styles. In the next section, we further elaborate on how extant research in these areas falls short if applied in the context of SISCM and propose corresponding future research directions.

Supply chain strategy

The first specificity of SISCM is the need to combine the commercial and social-welfare logics in the supply chain strategy. Indeed, focal organizations are embedded in a commercial and a social-welfare logic and need to develop unusual supply chains strategies to address such institutional complexity. The traditional SCM literature usually identifies supply chain strategies as a function of product characteristics such as demand and supply uncertainty leading to the classic supply chain strategies of efficiency, responsiveness, risk hedging, agility (Fisher et al., 1997; Lee, 2002). These strategies all imply a commercial logic in that the ultimate objective of focal organizations is to maximize profits by finding the appropriate combination between the cost of managing the supply chain and the service level to customers. In this literature, the idea of combing multiple objectives is not new and requires the development of hybrid supply chain strategies, as the literature on mass customization, agility, and lean testifies. However, these studies only consider hybridization of multiple commercial objectives, such as cost and quality (lean strategy) or responsiveness and risk-hedging (agile strategy). Instead, in the SISCM context hybridity can be defined as the combination of social-welfare and commercial logics in an economically viable way (Battilana & Lee, 2014). This will require future research to understand how to effectively design supply chain strategies that prioritize social objectives, or at least combine social and commercial objectives. Future research might deal with this research direction in descriptive and in normative ways.

Descriptive research opportunities: Identifying SISCM hybrid strategies. Previous research suggests hybridity in traditional SCM, multiple commercial objectives are combined synergistically. For instance, an organization applying lean operations performs the same set of activities to both reduce cost and increase quality (Womack & Jones, 2010). In the context of SISCM it is not clear what supply chain strategies are available to cope with institutional complexity. Moving beyond the classic cost vs. service trade off, new strategies are needed to achieve a social impact while making economic sense. Additionally, moving toward social goals might imply riskier and sub-optimal strategies in terms of economic goals compared to traditional SCM strategies.

Going beyond the three SISCM approaches we propose, future research could address other configurations of SISCM such as Decoupled with a social core and commercial peripheral and Coupled SISCM with a commercial core and social peripheral. UK-based non-profits Emmaus and Sue Ryder, have become sophisticated retailers and supply chain managers, generating a significant portion of their income to support hospice activities and other projects for the needy by generating additional income selling baked goods or used household good (Economist, September 2017). Similarly, Coupled SISCM with a commercial core and social peripheral are seen with corporations such as Ben & Jerry's Partnershops®. Similar to WISE programs, Partnershops® are community-based non-profits which offer job and entrepreneurial training to homeless youth in Ben & Jerry's ice cream stores with a parallel social supply chain with social agencies and potential employers. Here, the corporation provides support and waives franchise fees to Partnershops® (Ben & Jerry's, 2018). Future research might look at where these types of SISCM fall on the continuum of social impact as well as taxonomies of different SISCM strategies to understand how such strategies can be implemented across the supply chain and the implications for social impact and financial viability outcomes.

Normative research opportunities: Innovative SISCM strategies. The combination of social-welfare and commercial logics by a focal organization in SISCM might require different solutions than doing it through multiple goal combination or co-joined as prescribed by the institutional logics literature (Pache & Santos, 2013) and traditional SCM literature (Womack & Jones, 2010; Christopher & Towill, 2000). Based on the literature on institutional logics, the combination of multiple logics in SISCM might create different challenges such as risk of mission drift, when one logic (i.e., commercial logic) prevails on the other leading to deprioritizing or abandonment of social concerns in favor of profit-seeking activities (Battilana et al. 2014; Mair et al. 2012). Decoupling instead might lead to identity problems when different activities are managed following different logics (Battilana et al. 2014).

We propose innovative SISCM strategies beyond logic combination and decoupling strategies are needed for social enterprises to effectively manage their supply chains. The innovation occurring in SISCM is expected to include all parties, such as multiple tiers of suppliers, focal organizations, intermediaries, retailers, and consumers (Gao et al., 2017). Thus, the aim is not only to create value for the focal organization, but also to consider the needs of all stakeholders. Accordingly, innovativeness has been identified has a crucial capability needed to manage supply chains in social contexts compared to traditional SCM (Klassen & Vereecke, 2012; Pagell & Schevchenko, 2014; Longoni & Cagliano, 2016). In our continuum, Coupled SISCM is a more innovative approach than Decoupled or Combinatory approaches. In Coupled SISCM, stakeholders typically associated to one core logic (i.e., social-welfare) are called to integrate elements from the other logic to effectively deliver a social mission. This requires

innovative supply chain structures, roles and relationship management in the social enterprise's supply chain. Future research should investigate innovative SISCM strategies that social enterprises put in place to manage their supply chain and evaluate their effectiveness in enacting multiple logics, preventing mission drift, and improving their efficiency while maintaining their social commitment.

Stakeholder identification and engagement

Traditionally, organizations characterized by a commercial logic identify stakeholders accordingly to a firm's profit orientation as suggested by stakeholder theory (Freeman, 1984). In such a context, stakeholders have been classified as primary and secondary stakeholders (Clarkson, 1995). Primary stakeholders include those stakeholders continuously part of the value creation in the focal organization's supply network such as traditional suppliers and customers, a rather homogenous set of stakeholders characterized by profit orientation with clear roles in the focal organization's supply chain. If any primary stakeholder group, such as customers or suppliers, becomes dissatisfied the focal firm will be seriously damaged or unable to continue as a going concern. Secondary stakeholders are a more heterogeneous set of stakeholders including NGOs and mass media that are able to mobilize public opinion in favor of, or in opposition to, an organization. Traditionally, they have been considered as influencers, but they are not engaged in transactions with the corporation nor are they essential for its survival.

Conversely, focal organizations in SISCM identify stakeholders based on the combination of the social-welfare and commercial logics leading to different types of primary and secondary stakeholders. More specifically, in SISCM, primary stakeholders are characterized by greater heterogeneity than in traditional SCM. These actors include profit-oriented organizations such as good and service suppliers, private or corporate donors, as well as socially-oriented organizations such as other social entities and NGOs who are committed to the social mission of the focal organizations. All of these stakeholders take an active part in the supply chain, as volunteers, influencers or formal collaborators.

Each stakeholder is providing a different type of resource to the focal organization that is needed for its daily operations and can cover supply chain roles such as customers, supplier, intermediaries, distributors (Sodhi, 2015). In this context, those stakeholders normally considered secondary in traditional SCM and a source of pressure, could be identified as core actors in the focal organization's supply chain and are proactively engaged. This shift might require future research on how these stakeholders behave and take part in SISCM. Future research might deal with this research direction in descriptive and in normative ways.

Descriptive research opportunities: Identifying stakeholders' roles in SISCM. In traditional SCM, the roles of primary stakeholders such as suppliers and customers in value creation are clearly defined. They are economic actors participating in the physical and informational flows enabling the focal organization to produce and deliver its goods or services and taking a stake in the value created though economic transactions. In this context, the identification of stakeholders and their roles in the supply chain does not need specific analysis. But in SISCM, a focal organization has to identify who its primary stakeholders are in terms of profits vs non-profit, public vs private, and corporate vs citizens, which logic characterizes them and what their role is in the supply chain. It could be that in the supply chain of a social enterprise, NGOs might act as suppliers of information about people in need. This type of supplier will adopt a social-welfare logic in the way it acts and interacts with the social enterprise

as opposed to a traditional supplier with a commercial logic. In some cases, NGOs act as intermediaries in the focal firm's supply chain with people in need. We expect NGOs to be a different kind of intermediary than traditional traders, as they prioritize a social-welfare logic and possess a different set of skills and capabilities. Also, in some cases, suppliers, distributors or customers might be people in need which might introduce sources of risk and uncertainty and thus require specific engagement mechanisms such as non-contractual arrangements and non-coercive power mechanisms. Therefore, focal organizations in SISCM need to understand who their stakeholders are, what their institutional logic(s) is, what role they play in their supply chain and how to engage them in achieving the focal organization's goals.

Normative research opportunities: Balancing stakeholders' characteristics. The inclusion of stakeholders that are not profit-oriented might lead to suboptimal financial performance because of different priorities and working mechanisms. However, these actors are core to providing legitimation, social skills, and resources fundamental to the functioning of the focal organization's supply chain. Thus, focal organizations should be able to identify their stakeholders according to both social-welfare and commercial logics and balance them in order to achieve both social effectiveness and economic viability. Sodhi (2015) proposes the stakeholder resource based view (SRBV) as a framework to inform the decision-making of managers of a company towards maximizing their utility and also those of the company's stakeholders. Designing and managing supply chain partners with complementary capabilities has a positive impact on sustainability and value creation. Here, each stakeholder (or stakeholder group), with its individual view of the operations, has specific resources and capabilities. Therefore, the focal organization should be able to identify the resources needed according to both commercial and social-welfare logics and engage with a set of the stakeholders able to provide them.

Relationship management

Several disciplines have investigated inter-organizational relationships and their performance implications (Autry & Golicic, 2010). In traditional SCM literature, according to the commercial logic, these studies have focused on buyer-supplier vertical relationships (Terpend et al., 2008) and several classifications have been provided (e.g., Ahmed et al., 2017; Tangpong et al., 2015; Terpend et al., 2012). Among them, Tangpong et al. (2015) proposed a classification based on two main aspects: relationalism, the degree to which buyer and supplier firms promote behaviours that maintain or improve their relationship, and power dependence such as buyer/supplier dependence.

We expect that in SISCM, focal organizations will establish relationships not only with traditional profit-oriented organizations as in traditional SCM, but with all stakeholders identified above. This will result in inter-organizational relationships with a distinctive character relative to traditional SCM relationships in terms of relationalism and power dependence approaches. In contexts characterized by social-welfare logic stakeholders, relationships will have the goal of reciprocal exchange and will not only concern information, products, labor force, and/or financial means, but also more intangible elements such as compassion, education, and care (Tate & Bals, 2016). This leads to a new research direction on how stakeholder relationships are managed in a context characterized by greater institutional complexity particularly combining social-welfare and commercial logics. This research topic can also be investigated in a descriptive and normative way.

Descriptive research opportunities: Describing relationalism and power in SISCM. In terms of relationalism, the combination of social-welfare logic with the commercial logic might require additional altruistic rather than purely economic motives to define stakeholder relationship management (Tate & Bals, 2016). This can happen when the social enterprise is dealing with people in need, other social entities, or NGOs and it interacts with them in an altruistic fashion. On the other side, profit-oriented stakeholders, providing financial resources to the social enterprise, might act in an altruistic fashion toward the social enterprise if moved by shared goals or because of a desire to be associated with the social mission. This might require a new definition and typology of relationalism.

Additionally, power-dependence might be defined in a different way than in traditional SCM. In a commercial logic, the more powerful actor would likely exert control over the less powerful, possibly acting in its own interest. When an organization depends upon another for resources or performance and few alternative sources exist, we are likely to witness a power-dominated relationship. A classic example is when a buyer has power as a result of a high share of supplier revenues with that buyer and the availability of alternative suppliers or – vice versa – a powerful supplier as a result of high asset specificity and a limited supplier pool. Instead of being based on a commercial logic, in SISCM, power might be defined according to a social-welfare logic or a blend of the two logics. Based on a commercial logic, the social enterprise might be power dependent to market-entities because of funding and other resources needs. However, in a social-welfare logic, these organizations might have a different type of power in the relationship with market-entities, such as legitimacy-based and referent-based power which are proposed to be at the basis of social power (French & Raven, 1959). Legitimacy-based forms of social power stem from internalized values by the stakeholders who recognize the social enterprise to have legitimate authority to influence them in a specific social context; referent-based forms of social power stem from the willingness of the stakeholders to be associated to the social organization and recognize its influence.

Normative research opportunities: Investing in trust-based relationships to contribute to network stability, social effectiveness and financial viability. Shared experiences and information exchanges are vitally important for the focal organization's management of many different types of stakeholder relationships to identify key collaborators in the supply chain whose interests align with the social enterprise's mission, such as public, private, hybrids, community, and third party financiers (Kolk and Lenfant, 2015). As the nature of these relationships moves toward extreme aspects of relationalism, such as altruism and legitimacy- and referent-based power, institutional complexity might increase the role of trust in SISCM relative to traditional SCM. Trust refers to the confidence in another's goodwill and conformance to expectations (Ring & Van de Ven, 1994). Even though there is evidence that trust can have a positive effect on supply chain relationships, power dynamics have traditionally dominated relationships in traditional SCM.

Power and trust exist as different means through which a firm seeks to promote desired behaviours in a partner. They are complementary and opposing components of social behaviour through which firms can adjust social relations to achieve a desired outcome (Ireland & Webb, 2007). Usually one can substitute for another when one fails to achieve desired results. We propose that in an institutionally complex environment resulting from the combination of social-welfare and commercial logics, trust-based relationship might be more effective than traditional power-based relationships. However, previous studies show that increasing amounts of informal

trust-based relationships can magnify the chances of opportunistic behaviours (Ireland & Webb, 2007). Another risk of an excess of trust is the over-embeddedness stemming from the emotional attachment and efficiency of high-trust relationships rather than looking for alternative partners that might increase its effectiveness. In SISCM, the focal organization might stick to stagnating relationships, eventually compromising the social mission achievement. These risks can be hedged through specific control mechanisms that prevent opportunistic behaviours and reward innovation. In this sense, power can become complementary to rather than conflicting with a trust-based relationship. Thus, future research might investigate all these different relational nuances in SISCM and the most effective way toward social mission achievement and financial viability.

Conclusion

Previous SCM research has mainly focused on ways to achieve economic goals when dealing with sustainability issues leading to "less harm" solutions. Research about NGOs or humanitarian logistics has focused on the study of supply chains that address temporary and local social needs. In this study, we highlight a gap in theorizing and investigate focal organizations who provide a social good with the intention of being financially viable in the long term. Thus, we propose a definition of SISCM and describe different approaches taken by focal organizations combining commercial and social-welfare logics. SISCM appears fundamentally distinct from traditional SCM in terms of supply chain strategy, stakeholder identification and engagement, and relationship management due to the combination. This is the result of social enterprises experiencing institutional complexity and adopting hybrid SISCM approaches (i.e., Decoupled, Combinatory, Coupled).

We can envisage that SISCM approaches may also influence traditional SCM strategies and practices. For example, several for-profit companies are showing signs of going beyond Decoupled SISCM in their effort to improve the conditions of people in-need across their supply chain while simultaneously achieving economic goals. Illy, a global coffee roaster has worked for decades to improve the working and living conditions of farmers as a social goal per se but also as a way to ensure the quality and sustainability of green coffee (Longoni & Luzzini, 2016), and similar initiatives have been launched by companies like Nestle or Starbucks (Alvarez, Pilbeam, & Wilding, 2010). Future research might investigate the transition process of focal organizations from one SISCM approach to the other, possibly highlighting some intermediate stages in the continuum. The focal organization could potentially be any type of organization ranging from for-profit, benefit or B corporations to social entities. What will distinguish their approaches will be whether the social-welfare logic is peripheral or core as well as the level of centrality. Our fundamental argument is that hybrid innovative SISCM approaches emerging from the combination of social-welfare and commercial logics can foster social impact effectiveness in economically viable organizations. However, we do not deny the drawbacks and tensions arising from SISCM related to sub-optimal economic outcomes compared to traditional SCM or exposure to social mission drift. Thus, we encourage future researchers to explore this rich and complex area to understand how we can create more socially effective organizations and supply chains.

References are available upon request.

Figure 1
Continuum of SISCM Approaches

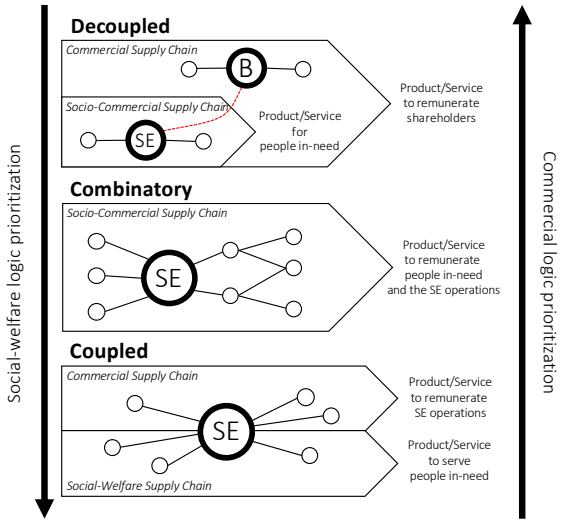

Table 1
SISCM Approaches Summary

SCM factors		Decoupled (Commercial)	Combinatory	Coupled (Social)
Context	**Focal organization**	Multinational company/ corporation or subsidiary	Social enterprise	Social enterprise
	Institutional complexity	Commercial logic core, social-welfare logic peripheral	Commercial and social-welfare logic centrality	Social-welfare logic core, commercial logic peripheral
SISCM strategy	**SISCM definition**	The for-profit focal organization sets up a SC to address business opport. in emerging markets	The social enterprise focal organization develops and manages a SC combining social and market logics	The social enterprise focal organization sets up two supply chains, a "pure" social supply chain to deliver a social service and a commercial supply chain to sell a product/service
	Primary SISCM purpose	Profit	Social and profit	Social and economic independence to serve the ultimate social goal
	Social provisional category design	Design product/service for people in need	Design a SC to include people in need in economic activities	Design a SC to provide skills and opportunities for people in need
	Focal organization operations management	Sell and distribute the product in emerging/bottom of the pyramid markets	Share information, provide resources and train people in-need	Manage flexible operations combining the social and commercial supply chains
	Focal organization supplier management	Build and coordinate a local "commercial" SC to deliver a product/service to local people	Connect people in need with local and international commercial organizations	Build a social SC to bring social issues from social entities to economic entities filling institutional voids; and an economic SC acting as a supplier/buyer in the market.
Stakeholder identification and engagement	**Customers**	People in need	Consumer/Clients	*Social SC*: People in need *Commercial SC*: Consumer/Clients
	Suppliers/Distributors	For-profit organizations	People in need	*Social SC*: Social entities *Commercial SC*: For-profit and/or not for-profit organizations
	Intermediaries	NGOs, social entities, governments	NGOs, social entities, governments	*Social SC*: Social-oriented organizations *Commercial SC*: For-profit and/or for-profit organizations
	Financing entities	Banks, shareholders	Local entrepreneur networks, donors, governments	*Social SC*: Local entrepreneur networks, donors, governments *Commercial SC*: Banks, shareholders
Relationship management	**Relationalism approach**	Transactional	Altruistic	*Social SC:*, Altruistic *Commercial SC:* Transactional
	Power dominance	Power-based Legitimacy-based with Suppliers/Distributors	Trust-based Power-based with Customers	*Social SC:* Referent-based with Clients and Suppliers/Distributors Trust-based with Intermediaries and Financing entities *Commercial SC:* Referent-based with Customers Trust-based with Suppliers/Distributors

Supplier Performance Impact on Construction Project Financial Result

Antti Puustinen
Lappeenranta University of Technology, School of Business and Management, P.O. Box 20, 53851 Lappeenranta Finland, antti.puustinen@student.lut.fi, Tel.: +358 40 847 9111

Jukka Hallikas
Lappeenranta University of Technology, School of Business and Management, P.O. Box 20, 53851 Lappeenranta Finland, jukka.hallikas@lut.fi, Tel.: +358 40 550 7499

Katrina Lintukangas
Lappeenranta University of Technology, School of Business and Management, P.O. Box 20, 53851 Lappeenranta Finland, katrina.lintukangas@lut.fi, Tel.: +358 40 833 6834

Kasper Åhman
Skanska Oy, P.O. Box 114, 00101 Helsinki Finland, kasper.ahman@skanska.fi, Tel.: +358 50 380 2560

Abstract
The objective of this research is to examine the impact of supplier performance on financial result of construction projects (projects' financial result). The research is a case research and is limited to project data specific to a single company. The study is conducted in a case construction company using the performance measurement data and project financial data collected from the company's reporting system. The performance indicators are calculated and the impact on project success is examined using Partial Least Squares (PLS) method. This study aims to establish the connection between best performing suppliers and best performing projects.

Keywords: Supplier performance, supplier management, procurement

Research background

Purchasing in project business and construction
Previous research regarding purchasing in project business have focused on buying processes and performance evaluations. It is found that the procurement procedures affect project performance (Eriksson and Westerberg, 2011). Furthermore, assessing supplier performance in projects and developing partnering mechanisms improve the operational and financial performance of the suppliers and thus the overall project (Cheng and Carillo, 2011). It is also noticed that buyers prefer suppliers' technical, operational and business capabilities instead of relational and developmental capabilities (Ruuska et al., 2012). Moreover, it is stated that the purchasing strategy selected in projects affects value creation. Short-term value elements have product focus and a competitive tendering basis whereas long-term value elements in projects focus on relationships with customers and suppliers and innovations (Ahola et al., 2008). In the project business environment, various project characteristics moderate purchasing procedures and project performance. The more challenging the project characteristics (complexity, customization, uncertainty value/size, time

pressure) are, the more cooperative purchasing procedures improve overall project performance (Eriksson and Westerberg, 2011).

Purchasing and supply management can have a major impact on the success of the construction project (Eriksson and Westerberg, 2011). However, numerous barriers to pursuing effective purchasing in projects have been reported in the previous literature (Gadde and Dubois, 2010). Especially, supplier management and partnering has been found challenging in construction projects (Bygballe et al., 2010) and mixed research results exists. For example, Dubois and Gadde (2002) have studied relationships correspondence with production in construction industry and have found that both tight and loose couplings favor short term productivity and seems to hinder innovation and learning. In other words tight relationships with suppliers do not lead to better project outcomes. In addition, Kamann et al., (2006) had similar findings but also recognized that stable and fixed individual contacts with the supplier firm limit coordination and transaction costs and enhance long-run supplier performance.

The previous findings are due to the fact that projects are unique, one-off settings and carry inherited risk and uncertainty because of their temporary nature (Baily et al., 2008). Moreover, decentralized purchasing in projects and competitive tendering is the prevailing practice in buying companies. Therefore, collaboration and supplier development in terms of improve supplier performance in projects is difficult to put in practice and integrated supplier network and close supplier relationships have not yet been widely adopted in project business (Crespin-Mazet and Portier, 2010).

Supplier performance and firm performance

As companies in project-based business have been pushed to seek performance improvements, they have recognized the potential of their supplier base and start to manage it as an extension of the company's manufacturing system (Carter, 1996; Sheth and Sharma, 1997). It is acknowledged that the performance of the supplier base is critical to the success of supply management function and company business (Tan et al., 1998), and thus, supplier performance measurement is one of the most important tasks in purchasing operations (Monczka et al., 1993). Large share of studies have demonstrated the positive relationship between purchasing and supply management activities and a multitude financial and operational performance metrics (e.g. Carr and Pearson, 1999; Narasimhan and Das, 1999; Ellram et al., 2002; Sanchez-Rodriguez et al., 2003). In addition, purchasing is viewed to contribute more than solely costs (Das and Narasimhan, 2000): vice versa, purchasing performance has been researched against financial measures such as return on investment, return on assets, market share, profits (% of sales), and net income.

Recently, suppliers's direct impact (Jajja et al., 2016) and indirect impact (Foerstl et al., 2013) on a buying firm performance has been in scientific discussion. Jajja et al. (2016) found firm's strategic supply chain (lean and responsiveness) correspondence with key supplier practices (quality, cost effectiveness, delivery, and flexibility) that have a positive impact on firm performance (operational, quality and market, and financial). Foerstl et al. (2013) results instead indicated purchasing and supply management indirect impact to financial performance lacking outward bound practices such as supplier integration, building buyer-supplier and supplier development. Nevertheless, firms and the density of the supply networks, along with the interaction between them, have been recognized to have a positive direct influence on the performance of firms as measured by the firm's asset utilization, cost performance, and operational efficiency (Basole et al., 2018). Further research by Al-Shboul et al. (2017) suggests also that higher levels of supply chain management practices (one being supplier performance) can lead to enhanced supply chain and firms' performance. Consequently, companies have paid more attention on supplier

relationships (Kannan and Tan, 2006) and an effective supplier management have become as a core competency of firms (Paulraj et. al., 2006). This has led to an increasing need of supplier performance data (Carr and Pearson, 2002).

Supplier performance and project performance: the research gap

Even though supplier's impact on firm performance is widely studied, supplier performance impact on project performance has stayed as rarely studied research topic. One of the few researches that studies the supplier performance correspondence with project performance is made by de Araújo et al. (2017). The results of the research emphasize selecting the right supplier and evaluating supplier's performance is important to ensure a good project outcome. Even though the results of the de Araújo et al. (2017) research are promising, the limitation in this context is that the research is a literature review and there are no primary research performed to test the taxonomy of the literature review. In construction industry context the topic is even less researched. However, some research close to the topic is conducted. For example, in this framework, similar researched topics such as partnering and construction supply chain (Gransberg et al. 1999; Eom et al., 2008) and supplier relationships contribution to project performance (Heredia-Rojas et al., 2015) are researched but these researches lack supplier performance perspective. Otherwise the supplier performance research is focused more on manufacturing performance such as the research by (Wegelius-Lehtonen, 2001) that acknowledge supplier performance measures to be used as a basis for progressive improvement of company productivity. Or research is focused more on supplier development strategies to identify the best suppliers and to improve suppliers' production processes and performance (e.g. Rogers et al., 2007).

Research approach

Despite the fact, there are several studies that explores similar type of research questions through case studies, this research addresses this topic quantitatively. In this research the research topic, supplier performance's impact on project performance, is researched through the case data. The link between purchasing practices and the overall performance of the company is investigated through quantitative studies, where financial performance of the case company's projects is applied as a success variable. Supplier performance evaluations are applied to complement studies and have an insight into more operational areas. In addition, contrary to previous studies (e.g. Carr and Pearson, 1999; David et. al., 2002; Ellram et. al., 2002) this study utilizes more objective success variable – profit margin of the project, instead of focusing to investigate the link between purchasing and supply management activities and corporate success through generic high-level measures such as return on investment or those mentioned earlier.

The objective of this study is to empirically examine the impact of supplier performance to the financial result of the construction project. The study is conducted in a construction company using the performance measurement data collected from the company's reporting system. The performance indicators are calculated and the impact on project success is examined using Partial Least Squares (PLS) method.

Supplier performance drivers in this research

The selection of supplier performance drivers in this research is based on the purchasing and supply management literature, the purchasing strategy of the case company and industry-specific requirements for the suppliers. Supplier performance management typically adopts different metrics for the evaluation. For example, cost, quality, flexibility, on-time delivery, and responsiveness indicators are utilized for measuring supplier performance (Paulraj et al., 2006). Supplier performance indicators and purchasing strategy form the basis for supplier classification

and describe the output of the purchasing and supplier management system. The assessment of supplier performance in projects and development of partnering mechanisms improve operational and financial performance of the suppliers and thus the overall project (Cheng and Carillo, 2011; Eriksson and Westerberg 2011).

Industry-specific requirements are necessary to take into account in this research as in the construction industry supply chains are non-traditional supply chains. In a traditional supply chain (e.g. Christopher, 1992) materials are sent to one factory, but in a typical construction supply chain a company needs to build its own factory around each object (Bengtsson and Gustad, 2008). Therefore supply chain and its suppliers' performance is dependent on contractors' internal processes and ways of working (Bertelsen and Nielsen, 1997). Thus purchasing performance is dependent on supplier's learning curve in terms of doing business with the firm – which may include understanding the firm's value, culture, and quality requirements among other issues (Janda and Seshadri, 2001). For example, suppliers work usually physically on the construction sites, which emphasizes the importance of work safety and site order aspects in supply – the common industry-specific issue. In addition to the drivers mentioned, the Net Promoter Score (NPS) is also included in as a performance driver. NPS measures the loyalty that exists between a *provider* and a *consumer* and presents the score that describes the loyalty (Reichheld, 2003). NPS is usually researched in customer satisfaction research e.g. to predict business performance (Morgan and Rego, 2006) and revenue growth (Keiningham et al., 2007) but is also tested how it improves business performance in supply chain (Ucenic and Ratiu, 2017). In this framework we aim to find possible impact of supplier recommendation on project performance. The supplier performance indicators used in this study are presented in the table 1 below.

Table 1: Supplier performance drivers in this research

Safety	**Reliability**	**Quality**	**Net Promoter Score**
Attitude towards safety	Representatives/supervisor's availability & expertise	Contract compliance	Recommendation to next projects (Yes/No)
Cleanliness, order & environmental consideration	Compliance with agreed timetables	Quality of the products / performance	
Compliance with safety instructions	Unfounded demands related to the contract	Development activity	
Development activity with safety	Billing & payment terms	Reactions and corrective actions towards claims/remarks	

Research question

The research questions is: *How supplier performance affects projects' financial result?* The objective is to find out the supplier performance relation to projects' financial result - in other words to find out the most critical supplier performance drivers that affects positively to project financial result.

Hypothesis

H1: Best performing suppliers are involved in projects with best financial result

Research framework

Research framework (Figure 1) presents the basic approach to this research. In core of this research, supplier performance drivers' impact on supplier performance is established and further on the supplier performance impact on projects' financial result is researched.

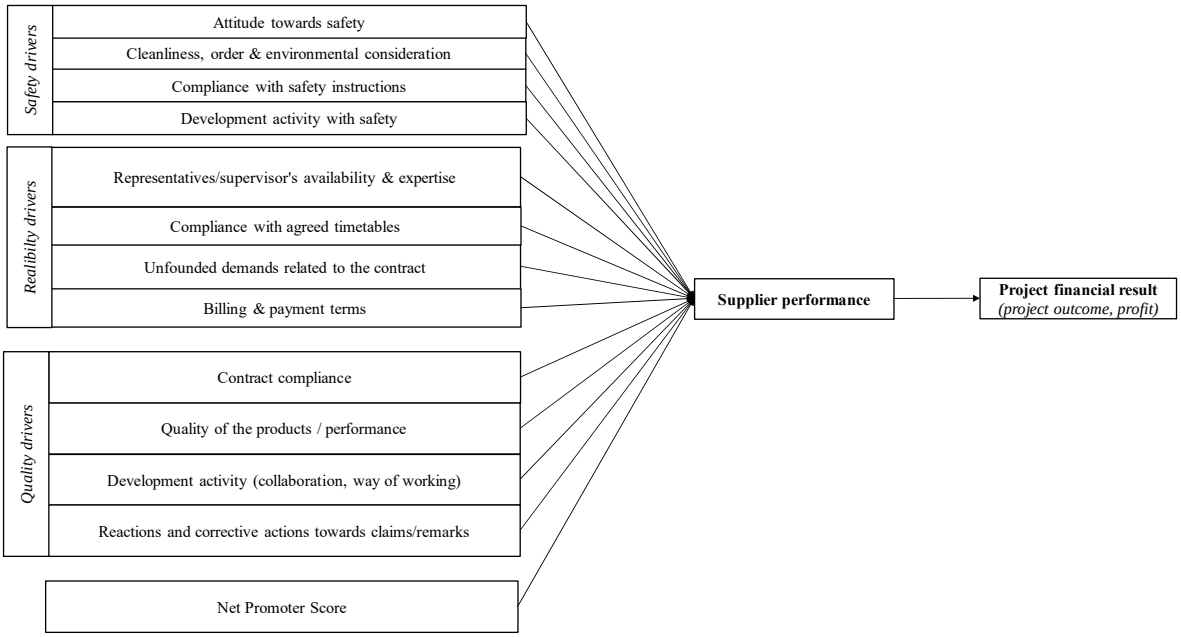

Figure 1: Research framework

Empirical Study

Methodology

The empirical study is based on the supplier performance and project data in the case construction company. The sample consists of altogether 241 projects in Finland and the supplier data includes performance assessment of 723 suppliers. The collected database consisted of variables from supplier performance and project performance. This research is a mixed method research where a case research is built around the quantitative research. In order to reduce the possible problem associated to the common method bias (CMB), the supplier performance and project performance data were combined from different data sources.

The collected data is based on the supplier performance evaluation instrument, which includes questions related to the supplier *Work Safety, Quality and Reliability* and *Net Promoter Score* using a Likert scale from 1 to 5. Suppliers in the each project were evaluated based on the instrument after the project was completed. This data was then combined with the direct project performance data of the case projects.

Survey Instrument

The measurement reliability of the constructs was assessed using construct reliability ('CR') and the variance captured by latent construct by average variance extracted ('AVE') (see e.g. Fornell and Larcker, 1981). According to Kline (2011) the CR coefficient should exceed .50 to indicate acceptable if the model validity otherwise is good. The measurement reliabilities are reported in the Table 2. The project margin variable uses standardized measures. It can be stated that all of the latent variables had acceptable reliability for further analyses. Only Margidevelopment variable does not has significant p-value, however, it will be used because construct measure are otherwise acceptable.

Table 2: Measurement reliabilities

	Loading	p-value	Mean	SD	AVE	CR
Safety					**0.567**	**0,839**
Safety1 *Attitude towards safety*	0.780	****	3.786	0.391		
Safety2 *Cleanliness, order and environment*	0.735	****	3.742	0.398		
Safety3 *Compliance with safety*	0.803	****	3.817	0.399		
Safety4 *Development activity with safety*	0.688	****	3.373	0.490		
Quality					**0.521**	**0.812**
Quality1 *Contract compliance*	0.746	****	4.080	0.403		
Quality2 *Quality of the product*	0.791	****	3.909	0.388		
Quality3 *Development activity*	0.710	****	3.654	0.464		
Quality4 *Corrective actions towards claims*	0.630	****	4.053	0.441		
Reliability					**0.493**	**0.795**
Reliability1 *Supervisor's expertise*	0.667	****	3.861	0.401		
Reliability2 Compliance with timetables	0.712	****	3.865	0.416		
Reliability3 *Unfounded contract demands*	0.676	****	4.191	0.445		
Reliability4 *Correct billing and payments*	0.751	****	4.200	0.429		
Project profit					**0.502**	**0.621**
ZProject margin	0.946	****	-0.001	1		
Margindevelopment	0.331	n	0.011	0.044		
Net Promoter Score					**1**	**1**
Useagain *Recommended suppliers*	1	****	20.83	15.09		

n) not significant, *) Statistically significant at p<0.1, **) Statistically significant at p<0.05, ***) Statistically significan
p<0.01, ****) Statistically significant at p<0.001

PLS Path Model

We analyzed the main effects in the model which are defined in the Figure 2. The path model presents only significant relationships. Other direct relationships were also tested, however, they were not defined significant. Mediation of the indirect effects were also assessed. The resampling of the data was repeated 5000 times with traditional Bootstrapping method analysis which is adequate for estimation of parameters in the model (Kline, 2011). We tested and validated quality of the structural model through the following steps; (1) collinearity issues and overall fit, (3) explanatory power, (4) path significances.

The collinearity and the model fit to the data was assessed in order to validate the structural model. The latent constructs did not indicate collinearity issues where the values remain clearly below critical value of 5. Root mean square residual covariance (RMStheta, critical value >.12) was also assessed to specify to assess the overall fit of the structural model (see Hair et al., 2016).

Here, model fit by RMStheta= .185 indicates that serious misspecification of the structural model does not occur.

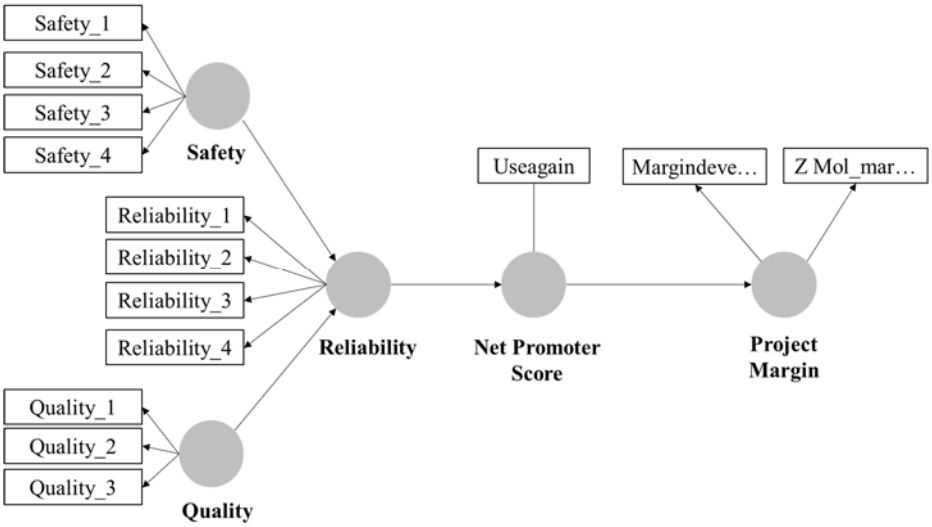

Figure 2: Conceptual model with t-values and (p-values).

The r-squared for the latent variables in the path model were; "Reliability " = .60, "Net Promoter Score" = 0.07 and "Project Margin" = 0.05. The default model (see Table 3) shows that the supplier "Quality" and the supplier "Safety" (Interop) have strong and significant positive influence on the supplier "Reliability" (SCI) which confirms these hypotheses paths in the conceptual model.

Table 3: Direct effects in the structural model to test the main hypothesis of the study

Hypothesis	**Path**	***β***	***T Statistics***	***P Values***
	Net Promoter Score -> Project Margin	0.217	1.754	*
	Quality -> Reliability	0.770	14.523	**
	Reliability -> Net Promoter Score	0.182	3.811	**
	Safety -> Reliability	0.139	2.380	**

n) not significant, *) Statistically significant at p<0.1, **) Statistically significant at p<0.05

The model also illustrates that supplier "Reliability" has positive influence on the supplier "Net Promoter Score" and the supplier "Net Promoter Score" has positive and significant influence on the "Project Margin". Furthermore, the assessment of indirect paths strongly indicates that the supplier "Reliability" mediates the relationships between supplier "Safety" and the supplier "Net Promoter Score", and supplier "Quality" and the supplier "Net Promoter Score".

Discussion and conclusions

In this study the impact of supplier performance in terms of quality, safety and reliability on project financial result were examined. It was found that there was no direct effect of performance indicators to financial result. Interestingly, it was found that the supplier performance influence logically buyer's recommendation to use the supplier again in future projects and buyer's recommendation had direct effect on project margin. Therefore the adaptation of Net Promoter Score defines the best performing suppliers that are involved in projects with best financial result. This seems to be supplier relationship issue: as more the supplier has received recommendations the more it has been used in projects. Within Transaction Cost Economics (TCE), the research

results indicate the emphasis of long-term supplier relationships with suppliers. Similar type of connection were found in the Carr and Pearson research (1999) where strategically managed long-term relationships with key suppliers was found (possibly) to have a positive impact on the firm's financial performance. These findings lead to an assumption that longer supplier relationships are beneficial for project outcomes. This is not uncommon phenomenon as the trend is somewhat recognized. Supply chain collaboration is noticed to increase in future (Sigh et al., 2018). Also, partnering and shared understanding has been recognized to offer improved construction at least in manufacturing industries (Bygballe et al., 2010). This indicates that at least early supplier involvement has landed into construction industry and project business: the typical transactional business within suppliers is not the only choice for project business.

The outcome of the research implicates that supplier performance drivers must be researched further as this research hypothesis were not found to hold unambiguously. In addition, factors that affects the success of a construction project must be researched and try to test against supplier performance drivers to find out how best performing suppliers are involved in projects with best financial result.

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Biodiversity Preservation:
A Case Study of Sustainable Supply Chain Management Practices

Anne Quarshie[1], Asta Salmi[1], Joanna Scott-Kennel[2] and Anni-Kaisa Kähkönen[1]
1 Lappeenranta University of Technology, Finland
2 University of Waikato, New Zealand

Abstract
This paper addresses biodiversity preservation – one of the most critical environmental issues currently facing our planet. Yet, rather surprisingly, biodiversity preservation has received very little attention by management scholars. This paper aims for greater understanding of these issues by focusing on exemplary practices of sustainable supply chain management that specifically address biodiversity. Our four company cases, representing natural resources-based sectors from Finland and New Zealand, show how companies can develop novel sustainability practices to help slow down or halt biodiversity loss in practice.

Keywords: Sustainable supply chain management, Biodiversity, Environment

Introduction

Biodiversity preservation has emerged as one of the most pressing environmental challenges facing the planet today and in the future (Crist et al., 2017; Steffen et al., 2015). While environmental scientists fear that a mass extinction event may already be under way (Ripple et al., 2017), the effects of biodiversity reduction are often invisible or appear disconnected from the activities that caused them, making the issue difficult for firms and individuals to address in practice. In many industries, the negative impacts on biodiversity are greatest at sub-tier supplier level where resources and raw materials are produced or extracted. Hence, cooperation with supply chain partners can provide an important way for firms to tackle the biodiversity loss that results from, or is otherwise connected with, their products and business operations.

While scholars have recently turned increasing attention to other environmental issues such as climate change, biodiversity preservation has, to date, received very little attention in the management research field (Whiteman et al., 2013). This is also the case in sustainable supply chain management (SSCM) research (Carter and Rogers, 2008; Seuring and Müller, 2008), where environmental sustainability has raised considerable interest (Lintukangas et al., 2016; Tate et al., 2013), but with scant focus on biodiversity in particular (Quarshie et al., 2016). To extend findings of previous studies, we adopt a multiple case study approach centered on companies who have taken an active approach to this challenge. In order to analyze company activities in depth, we carry out a qualitative investigation of four companies' SSCM practices that drills down into this issue of potential biodiversity loss. Our empirical material comes from natural resources-based sectors in two national contexts: Finland and New Zealand.

The biodiversity imperative and supply chain management

Biodiversity can be understood as the variability of life on the planet (CBD, 2000). Degradation of ecosystems – more dramatic in the past 50 years than any other time in history – is inextricably linked to human activity, wellbeing and political, economic, and technological change (Reid, 2005). Therefore, loss of ecological diversity becomes a critical issue not only for individuals, national governments and global institutions but also for corporations (Ripple et al., 2017; Salmi and Quarshie, 2017). Biodiversity loss is especially relevant for firms

operating in natural resources-based industries, such as agriculture and forestry, where land conversion, pesticide and agrochemical use, pollution, and modern production practices cause significant threats to ecosystems, habitats and species (Hanski, 2016; WWF, 2012).

The topic of biodiversity seems to bring new actions, trade-offs and impacts to firms' sustainability agendas. Unfortunately, although sustainability is often addressed at a strategic level, there is overemphasis on reporting of visions rather than meaningful change to firms' and suppliers' potentially harmful practices at operational level. These frequently remain entrenched and more challenging to address. Thus, SCM can be an important area for addressing biodiversity issues because of its boundary-spanning role and the firm's influence over suppliers. It centers directly on impacts occurring at operational level.

In the SCM discipline, research on sustainability and responsibility continues to grow steadily (Crespin-Mazet and Dontenwill, 2012; Miemczyk et al., 2012; Quarshie et al., 2016), and there is a fairly comprehensive body of knowledge on how firms may seek to create more sustainable (or less harmful) supply chains (Pagell and Shevchenko, 2014). Nevertheless, relatively few studies aim to generate understanding of more fundamentally different SCM approaches and practices. Amongst such studies, Montabon et al. (2016) present a competing logic to conventional SCM that aims at true, ecologically-dominant sustainability where practices are optimized to eliminate harm with a long-term view, rather than to maximize profits in the short-term. Montabon et al. (2016) further argue that by adopting such radical perspectives companies could develop significantly more sustainable supply chains operating within broader social and ecological systems.

Several previous studies have focused on SSCM practices, and categorized these into internal and external practices based on organizational structure (Gualandris et al., 2014; Vachon and Klassen, 2006), green and social practices based on the dimension of sustainability (Hollos et al., 2012), or according to the nature of the practices (Beske and Seuring, 2014). Based on their literature review, Hoejmose and Adrien-Kirby (2012) state that codes of conduct are the most common way of implementing and extending CSR practices in buyer-supplier relationships. A code of conduct builds on a company's CSR policy and has to be transformed into purchasing principles and supplier selection criteria in order for it to be implemented (Leire and Mont, 2010). Moreover, supplier selection criteria based on sustainability factors have been found to be critical for ensuring sustainability in supply chains (Datta et al., 2012; Roerich et al., 2017). The role of supplier auditing has also been highlighted as a key practice (e.g., Grosvold et al., 2014; Leire and Mont, 2010) and studies have pointed out the importance of adopting international standards both in the buying company and in the supplier company (Vachon and Klassen, 2006). The depth and quality of supply chain relationships are seen as critical facilitators of sustainability in supply chains (Touboulic and Walker, 2015), and recent studies (e.g., Beske et al., 2014) have shown the importance of collaboration in ensuring sustainability. Overall, exploring the different governance mechanisms and relationship types has been one of the main foci of SSCM research (Govindan et al., 2016; Quarshie et al., 2016).

However, current SCM literature discusses sustainability as quite a generic overall concept and more detailed phenomena, like biodiversity preservation, are rarely the focus of SSCM studies. There is also little inquiry into practical examples on how companies manage such sustainability-related phenomena. To further contribute to an understanding of biodiversity management in supply chains, the objective of this paper is to provide illustration of exemplary practice being implemented in the supply chains of four case companies. We focus on natural resources-based industries, namely textiles, forestry, agriculture, and fishing, where biodiversity is a particularly important issue (WWF, 2012, Salmi and Quarshie, 2017).

Methodology

A multiple case study methodology (Yin, 2009) is used in this study. The four case companies represent natural resources-based sectors: textiles, forestry, agriculture, and fishing. As our study focuses on exemplary SCM practices that address the issue of biodiversity, we sampled organizations considered to be leaders in sustainability and biodiversity management. We selected cases from Finland and New Zealand through a sampling process that involved searching through sustainability-related professional associations' websites and other relevant forums as well as asking professional and academic experts in the area of sustainability to suggest exemplary firms as case companies. After identifying such firms, we approached them and proceeded to select and interview knowledgeable informants from these firms regarding biodiversity-related business and SCM practices. Semi-structured interviews in the case companies form the main source of data for this study. Furthermore, we retrieved relevant company documents and other archival materials. Our data analysis and reporting procedures involved us searching for patterns related to biodiversity management, firm practices, and impacts of firm activities in the interview tapes, notes and other materials. We then wrote case descriptions of the companies' activities and practices based on them. The results are described in detail next, as well as summarized in Table 1 in the discussion and conclusions section.

Findings

In this section, we present our four empirical cases, focusing especially on the sustainability practices that these firms have developed to enhance biodiversity in their own operations and those of their supply chains. Each of these firms have been recognized in their efforts to further sustainability through their core business and SCM activities. Their novel practices and strategies for addressing biodiversity reduction offer examples that other firms can follow.

Case 1: Textile Company

The first case company, Finlayson, is a Finnish textile firm with a global supply network. The company's business and products derive from natural resources, with cotton being the most important raw material. The final products are manufactured in audited textile factories in Turkey and other European countries, but the company's supply chains are highly complex and extend to other continents as well.

The most significant biodiversity impacts relating to Finlayson's operations and supply chain occur in cotton production at the sub-tier supplier level. Cotton production causes various (negative) biodiversity impacts attributable to heavy agrochemical use, irrigation (which reduces local, often scarce, water supplies), and habitat loss (WWF, 2012). Moreover, the processing of cotton has considerable biodiversity and other environmental impacts along the supply chain. As in textile supply networks more generally, our case company's raw materials are difficult to trace to the farm-level. Through extensive efforts to improve transparency and traceability, the company has been able to establish that the most important production countries for the cotton used in its products are India, Pakistan, Turkey and the USA.

To decrease the biodiversity (and other sustainability) related impacts of its products, the firm has adopted or developed several SSCM practices. First, improving traceability is important. Second, the company supports full transparency, and has published the list of factories where its products are made, as well as the countries of origin for its raw materials. Further, the company is increasing the percentage of certified (e.g. Faitrade and organic) cotton used in its product portfolio, because otherwise it has very little control over the production methods of sub-tier suppliers. At the same time, it has started substituting cotton for other, more

environmentally friendly raw materials, including linen, wood fibers and recycled materials, where possible and feasible (e.g. considering product attributes and raw material prices). Finally, Finlayson has started collaborating closely with several of its first-tier suppliers in an effort to embed sustainability into extended supply chains. For example, it is launching pilot projects that focus on reducing the detrimental water impacts of its supply chains. Such measures are beneficial to enhancing biodiversity in cotton production, as well as in local communities surrounding producers and processing facilities.

Case 2: Forestry Company

The second case company, UPM, is a Finnish-based forestry company, which has developed an extensive, internationally recognized biodiversity management program as part of its overall sustainability initiatives. The biodiversity program helps to ensure sustainable forestry and maintenance and enhancement of biodiversity in the company's commercial forests.

UPM especially focuses on six aspects of forest biodiversity, and has developed ambitious global targets to guide its local activities and efforts in these areas. The elements are: 1) Native tree species, 2) Deadwood, 3) Valuable habitats, 4) Forest structure, 5) Water resources, and 6) Natural forests. The biodiversity program has been found to have had a broad range of positive impacts in these areas, including the diversification of tree species, an increase in the amount of deadwood in forests and the number of protected forests, the identification and protection of valuable habitats, changes in the structure of forests, and improved impacts on water resources.

The company has also developed multiple best practices for sustainable forest management and harvesting, as well as wood sourcing. The forest management and harvesting practices are not only piloted and adopted in forests owned by the company itself, but also diffused to privately-owned forests through long-term (forestry services) contracts and supplier development. Further, the company promotes sustainability certification standards to private forest owners in an effort to help raise industry standards. Overall, through such forestry management and wood harvesting practices, a wide range of biodiversity impacts get addressed in forests. For example, it is now considered essential to leave deadwood also in commercial forests, as well as to identify those sites and habitats that will not be exploited or touched at all. Moreover, the firm promotes mixed forests where several tree species are grown together, because biodiversity is richer in such forests than in monoculture forests.

As for UPM's sustainable sourcing practices, it only accepts legal and controlled wood, and will not purchase wood from rainforests or from plantations that are located on converted forests. Further, its 2030 supply chain sustainability goals include being able to trace 100 % of the raw materials it buys, and sourcing all of the raw materials from suppliers covered by the supplier code. As for progress made to date, the company has already reached its traceability target, and 94 % of the suppliers (measured in contract value) have signed the code of conduct.

In addition to the forestry management and sourcing practices, UPM has developed two additional sets of practices that are key components of the biodiversity program. First, the firm has initiated a broad range of collaborative stakeholder and partnering efforts related to biodiversity preservation. Indeed, the company considers a wide range of supply chain members (e.g. customers and suppliers) and non-traditional partners (e.g. NGOs, government agencies, communities, researchers, and the media) to be critical partners in the work for biodiversity. Second, the company has participated in voluntary activities related to the protection of forests, including the establishment of a new national park. Because of its extensive efforts to protect biodiversity, UPM is widely considered a sustainability leader in this area in Finland and internationally.

Case 3: Agriculture Company

Soilfood is a Finnish agriculture company that seeks to provide farmers a comprehensive portfolio of recycled fertilisers, soil amendments, and ecological farming training and guidance. Its products and services are designed to help farmers to decrease the negative environmental impacts of farming, while increasing crops, reducing production costs, and improving profitability. The company is an SME firm with 15 staff and an annual turnover of over 4.5 million euros.

Soilfood's business model is based on circular flows, as it uses side-streams and by-products from the forestry and bioenergy industries as raw materials. From these locally sourced raw materials, it produces ecological, recycled fertilisers and soil amendments for sustainable farming, in particular, which suggests that biodiversity is central to the company's business model. Suppliers have partnered with the company in order to be able to effectively dispose of production side streams and by-products in an environmentally friendly way. Because its upstream supply chains are based on circular flows or near sourcing of (recycled) inputs, the company's operations are always highly local.

Soilfood seeks to address biodiversity impacts in its downstream supply chain especially through selling ecological fertilisers and soil amendments to its customers (individual farmers). Indeed, the products it sells help to add organic matter to the soil in farmlands, which helps to create healthier ecosystems and to increase the diversity of microbes, algae, fungi, insects, and other animal and plant species below and above-ground. In addition, the training and guidance that the company provides the farmers concerns the choice of species and other environmentally-friendly farming practices, for example. These two practices can considerably increase biodiversity on farmlands. Overall, the company hopes to participate in the transformation of the agriculture sector, by helping to mainstream a new biodiversity paradigm, where a larger number of crops are grown together, using ecological farming techniques and fertilizers. To try to achieve such a transformation, the company seeks to ensure that its products are easy and affordable for farmers to purchase and apply, and that the farming techniques help to maintain farm productivity and profitability.

Case 4: Fishing Company

New Zealand's seafood industry is described as world-leading (www.mpi.govt.nz/protection-and-response/sustainable-fisheries/) thanks to the establishment of a quota management system (QMS) twenty years ago. As the largest quota holder, the case company Sanford has embedded sustainability across all facets of operations. This is fundamental to its success and continuous value creation – from reputational to bottom line benefits. Sanford's role in the QMS by scale and diversity of species involved (encompassing 87 species and 313 fish stocks) is notable, being uncommon in fisheries elsewhere (Sanford, 2016, pp. 86-87).

Maintaining healthy oceans through sustainable fishing is key to Sanford's business model and one of the CEO's core messages is that the seafood industry has to be sustainable to survive (Sanford, 2016; Hunter, 2017). The company believes strongly that biodiversity of marine resources, as part of a wider sustainability focus, has a direct or indirect impact on Sanford's ability to create, preserve or erode economic, environmental or social value for itself, its stakeholders and society, at large. Sandford's business model focuses on value creation – transitioning from a traditional commodity-driven high volume business, to creating more value for every kilogram of raw material produced, which means making more money from each fish sold rather than selling more fish.

Sanford integrates a number of sustainability initiatives throughout its operational supply chain consisting of 474 independent sharefishers, 50 fishing vessels and seven processing sites.

Initiatives include zero tolerance for overfishing, underreporting and discarding catch; avoiding fishing areas with young fish stocks; electronically monitoring catch by species and size to preserve breeding capacity and diversity; and prohibiting use of fish aggregation devices (FADs) in tuna fishing (Sanford, 2016). Further, Sanford has invested over NZ$200,000 into developing and installing cameras in fishing vessels in order to monitor catch and processing activities on board. Traditional fishing methods have also been adapted to minimise accidental by-catch, particularly of protected species, such as the New Zealand sea lion (www.sanford.co.nz/sustainability/environmental-impact/). In partnership with two other fishing companies (Moana New Zealand and Sealord), the Ministry for Primary Industries (MPI) and scientists from Plant & Food Research Precision Seafood Harvesting (PSH) technology is being developed and may eventually eliminate traditional trawl nets (www.sanford.co.nz/sustainability/precision-seafood-harvesting/).

Sanford operates 210 aquaculture farms across New Zealand. Its salmon farms are regularly relocated to limit their environmental impact, and the company works closely with suppliers to ensure protein levels in fish feed are optimal, then controls feeding through underwater camera monitoring to prevent feed loss and nutrient enrichment in the ocean. In 2015, joint development by Sanford and MPI saw the establishment of a pilot-scale mussel hatchery ($SPAT_{NZ}$), which aims to produce mussel spat to reduce pressure on, and variability of, wild spat from New Zealand's unique green-lipped mussel population. Selective breeding for commercially desirable traits in a controlled environment, and ensures safe and sustainable supply of spat, thus maintaining security of supply and biodiversity in the population.

Initiatives for protecting and enhancing the environment extend beyond the sea to encompass Sanford's whole value chain including staff, suppliers and a diverse range of stakeholders. Staff are encouraged to think innovatively and share ideas for potential sustainability initiatives, including taking action, for example, fishers who cut nets to release dolphins but lost the entire catch. Suppliers are evaluated on sustainability criteria to ensure participation and commitment to sustainable development principles, reduction of adverse impacts on the environment through use of biotechnologies, resource efficiency and waste production (for example, in relation to salmon feed). Continuous improvements to the eco-efficiency of the organisation include energy, emission and waste reduction and a zero fish waste policy.

Through stakeholder collaboration and consultation Sanford protects endangered species, including the threatened black petrel, by making vessels more 'seabird-smart'. Skipper training and mitigation devices have been installed on all vessels to keep birds at bay when landing catch. Working collaboratively with fishing company, Moana New Zealand, and WWF-New Zealand, Sanford has helped ensure Maui-safe fishing in the rare dolphin's habitat along the west coast of the North Island. Sanford is active in a number of industry working groups that advocate and support sustainable principles and the CEO co-chairs the business-government Natural Resources Sector (NRS) CEO group, which aims to improve the productivity of New Zealand's resource-related industries, while reducing their environmental impact.

Sanford prides itself on its leadership in New Zealand fishing with multiple accreditations and awards relating to their sustainable aquaculture practices and reporting, including 14 years of ISO14001 Environmental Management System certification, and Best Aquaculture Practices (BAP, Big Glory Bay King Salmon and Greenshell™ mussels). The company conforms to the Marine Stewardship Council (MSC) Chain of Custody requirements and follows international, professional benchmarks to promote robust and sustainable processes throughout the supply chain. The MSC chain-of-custody certification provides a scientific method for assessing ecologically sustainability across the supply chain and Sanford continues to engage with, and support, ongoing efforts to achieve certification for the major large volume deepwater species.

Discussion and conclusions

The analysis we presented above of the efforts of the four case firms in addressing biodiversity reduction in supply chains is intended to further our understanding of novel practices and other firm actions in this area. The relevance of our case selection is apparent when we consider that all firms operate in global industries known for adverse environmental impact on biodiversity (WWF, 2012; Hanski, 2016). Yet, our results suggest that one unifying aspect across the cases is that all have integrated biodiversity considerations into their overall sustainability and business strategies, and approach biodiversity as an integral part of their business operations. Further, sustainability extends beyond the company boundaries to incorporate supply chain participants and in some cases, governmental agencies, NGOs, and industry participants.

Table 1 presents a summary of key actions taken by the firms to promote (operational) sustainability, and more specifically, to enhance biodiversity in their supply chains. These include an ecological focus in terms of resource usage and waste, certification, and reporting of sustainability measures that raise stakeholder awareness. Although the impacts of their actions at operational level are positive, they are unlikely to make significant difference beyond the local sphere without wider industry participation. However, we can also see boundary spanning activities that encourage, engage and enforce supplier and wider industry participation and collaboration in improving sustainability and biodiversity in business practice. Industry engagement is not only reinforced through supplier choice and development, but also active involvement and leadership in industry initiatives and development of specialist technology. The importance of supply chain and industry collaboration, therefore, cannot be overstated as positive joint action reinforces change and enlarges impact beyond the boundaries of the firm.

Another important action is transitioning toward fundamentally different business models that emphasize sustainability principles (e.g. value over volume, circular economy and biodiversity paradigm). It remains to be seen whether firms embracing such business models are sustainable (relative to other firms) in terms of profitability in the longer-term. Complementarity rather than trade-off between ecological goals and profitability is imperative to the success of such models. Encouragingly, we find that our case firms favored a medium- to long-term approach toward biodiversity preservation. Casual distance between actions and long-term outcomes is likely to continue to impede attempts to measure and to monitor individual firm impact beyond the local sphere, hence the imperative for wider participation and transition to new business models embracing sustainability.

While this study is just another step toward understanding corporate biodiversity initiatives, it makes a number of contributions to existing SSCM research and managerial practice especially in the area of biodiversity management. First, our study can advance understanding of exemplary SSCM practices developed by firms operating in natural resources sectors that aim to address the issue of biodiversity protection in local communities along supply chains, under water, in forests and on agricultural lands. Second, these cases show innovative practices and concrete actions and in doing so, demonstrate the diversity of active response possible to address biodiversity reduction. As biodiversity preservation has so far received only limited attention by managers, particularly at the operational level, we expect our study to further understanding of how firms may tackle the issue in practice. Finally, with this empirical study we aim to bring the topic of biodiversity loss more centrally into the agenda of SSCM researchers, contributing to more scholarly work in the area. Future studies are needed in other industries and countries. Moreover, we have concentrated on practices from the companies' perspective but evidently we need richer first-hand understanding of how other actors and stakeholders act on this environmental challenge.

To conclude, this study shows how companies can develop novel sustainability practices that can help slow down or halt biodiversity loss in practice and thus act as part of the solution rather than (only) part of the problem.

Table 1: Summary of findings across cases

Sector	Textiles	Forestry	Agriculture	Fishing/Aquaculture
Key actions to promote sustainability at strategic and operational levels	Embedding sustainability in core business Sustainability reporting Reducing greenhouse gases Reducing waste Reducing water impacts	Embedding sustainability in core business Ambitious sustainability targets Sustainability reporting Biodiversity program	Business strategy based on sustainability Brand based on sustainability Embracing biodiversity paradigm	Embedding sustainability in core business Value rather than volume Eco-efficiency and zero waste Sustainability reporting
SSCM practices to enhance biodiversity in supply chain	Traceability Supplier management and relationships Certification Industry collaboration Raw material choice	Traceability Sustainable forestry management and harvesting practices Supplier code of conduct Supplier management and relationships (e.g. long-term contracts) Certification Stakeholder collaboration	Selling ecologically friendly products to farmers Training farmers Use of recycled raw materials (e.g. forestry side-streams)	Supplier management and relationships (e.g. commitment) Technological development Industry collaboration Benchmarking MSC Chain of Custody (Re)location of activities
Impacts at operational level	Decrease in use of toxic chemicals (through certification and raw material choice) Improved water impacts in ecosystems	Increase of deadwood & number of plant and animal species in forests Impacts on forest structure Impacts on valuable habitats Improved water resources Increase in natural forests	Enhanced soil quality Increase in plant and animal species on farmlands	Preservation of endangered species Minimisation of by-catch and under-size fish Enhanced breeding Controlled feeding
Long or short term (profit oriented) view of sustainability	Medium to long-term	Medium to long-term	Long-term	Medium to long-term

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Social sustainability in BoP markets: How to enable micro-retailers' business continuity

Jorge A. Rodríguez

ESPAE Graduate School of Business. Escuela Superior Politecnica del Litoral, ESPOL.
Av Malecon 100 y Loja, 090112, Guayaquil, Ecuador
rorodrig@espol.edu.ec ;Telf: +593 4 2081084

Abstract
Micro-retails in neighborhoods are still the main marketing channel for food and beverage items in Latin America and Africa. Neighborhoods of low income population present social challenges for the channel. For instance, small shop owners usually lack the permits to operate the business, get highly leveraged with informal money lenders, and have administrative problems in managing the incomes and costs of the businesses. Some food and beverage manufacturers are aware of this situation and are undertaking initiatives to enhance shop owners' administrative and leadership skills to increase the likelihood of continuity of these small businesses. This paper explores how focal firms can support micro-retailers to continue with their business in the long term. Specifically, this paper aims to answer the following research questions: 1) how is supply chain partners' continuity conceptualized in the context of urban BoP micro-retailers?; and 2) does capability-building interventions by focal firms enhance BoP micro-retailers continuity? The paper contributes to the literature of socially-responsible supply chains by improving our understanding on how distribution practices contribute to making supply chains sustainable.

Keywords: Social sustainability; Business continuity; BoP markets

Introduction

Small shops in neighborhoods are still the main marketing channel for food and beverage items in Latin America. Although the internet channel and large-area retailers have increased their participation, sales in neighborhood shops still account for about 50% of the food and beverage category (SCALA, 2015). This proportion is even higher in urban low-income neighborhoods, some estimations indicate that above 80% of customers in this segment purchase food and beverage items in neighborhood shops (SCALA, 2015). Yet, shop owners in low income neighborhoods are exposed to social, and environmental risks; and lack the resources or capabilities to grow their businesses for enhancing the economic sustainability of the supply chain. For instance, neighborhood shop owners are exposed to high social and environmental events such as: drug trafficking, robbery, homicides, and floods. In Latin America, crime rates and robbery incidents are usually higher in low income neighborhoods (Worldbank, 2014). Also, in developing countries low income population neighborhoods usually started as invasions, in risky settings such as hills, near rivers or mangles. As cities grow infrastructure is built around these areas, but natural risks, such as floods or landslides, remain (Moloney, 2017).

Additionally, neighborhood shop owners in urban low-income settings also lack the knowledge, information, or skills to make their businesses grow. For instance, most of them lack the permits to operate the business, get highly leveraged with informal money lenders, have administrative problems in managing income and costs of the business, and lack access to credits from local banks to invest in the infrastructure of their shops. Hence, food and beverage manufacturers should address the issues of this distribution channel to secure the generation of income in the long term.

Some food and beverage manufacturers are aware of neighborhood-shop owners' situation. For instance, AB InBev, has a training program for neighborhood-shop owners in several countries of Latin America. The training program aims to develop administrative and leadership skills of neighborhood shop owners (Jenkins, 2015). The results of the program indicate that shop owners have increased their profits and the orders made to AB InBev. In a similar way, Grupo DIFARE, a leading pharmaceutical distributor in Ecuador, has a training program for their franchisees' employees of *Farmacias Comunitarias*, a franchise that sells medicines and OTC (over the counter) products to low income population (DIFARE, 2015). However, there is scant research about how firms can enhance the business sustainability in the downstream supply chain of urban low-income markets.

Previous research in SCM literature has suggested the distribution in the Bottom of the Pyramid (BoP) as a promising research area (Sodhi and Tang, 2014). Sodhi and Tang (2014) suggested to focus on the design of distribution networks for rural and dispersed consumers, but the situation of distribution for neighborhood shops in large cities is different because these areas are highly dense. Additionally, low income urban areas have infrastructure challenges for efficient last-mile logistics, such as insecure environment for distributors, narrow and bad quality roads for trucks (Merchan et al., 2015). On the other hand, there are node-level challenges for the micro-retailers (e.g. social and environmental risks, and lack of resources). Consequently, there is little knowledge on how focal firms in the supply chain could enhance the business continuity of micro-retailers in low-income urban regions.

This paper builds upon the conceptualization of supply chain partners' continuity, which previous studies suggest it is a central concept of sustainable supply chain management (Beske and Seuring, 2014; Pagell and Wu, 2009). This concept emerged from the study of upstream sustainable supply chain management. Yet, this concept can be relevant in the downstream of BoP supply chains, because of the dependence of food and beverage manufacturers on micro-retailers for introducing their products in urban low-income population. Furthermore, previous studies in social sustainable supply chains suggest that capability-building interventions are effective to enhance the social sustainability of the upstream supply chain (Distelhorst et al., 2017). In this regard, it is proposed that capability-building interventions might be useful for other contexts in socially sustainable supply chains (Lee and Tang, 2017). Thus, this paper explores how business continuity is conceptualized in the context of urban low-income population markets; and assesses whether capability-building interventions (e.g. training to micro retailers in inventory management, bookkeeping, and leadership) enhance micro-retailers' business continuity.

This paper contributes to the literature of socially-responsible supply chains (Lee and Tang, 2017; Sodhi and Tang, 2014) by studying social supply chain practices in the context of BoP distribution. The results of this paper would enhance our understanding of the types of practices that supply chain managers can undertake to make their supply chains truly sustainable.

Literature review

Supply chain partners' continuity and sustainable supply chain management

Sustainable supply chain management (SSCM) refers to the cooperative approach between firms and its stakeholders for managing the material, financial, and information flows to achieve goals in the triple bottom line of the focal firm (Seuring and Müller, 2008). In this regard, truly sustainable supply chains are the ones whose operations have at least no negative effect on the environment and society (Pagell and Shevchenko, 2014).

Previous studies have proposed supply base continuity as a core concept within SSCM (Beske and Seuring, 2014; Pagell and Wu, 2009). Pagell and Wu (2009) proposed the concept of supply base continuity, which refers to buying firm's activities to support

suppliers to stay in business in a manner that allows them to thrive, innovate and grow. This concept includes decommoditization, supplier development programs, reducing supplier risks, and transparency. Furthermore, Beske and Seuring (2014) conceptualized continuity as a critical category of SSCM. The category contains the following issues: supply chain partner development, long-term relationships, and supply chain partner selection. The research about continuity within SSCM is scant, and most of it has been conceptual or case based research about the upstream relationships in the supply chain. To the best of our knowledge, there has not been studies about supply chain continuity in the downstream side of supply chains.

Socially responsible supply chain studies also indicate the relevance of supply chain members' continuity. Socially responsible operations refer to the study of operations management through the lens of corporate social responsibility (Sodhi, 2015). This means that operations analysis should take into consideration the expectations, utility, resources and capabilities of their stakeholders. Furthermore, others studies have suggested that socially responsible operations in the context of emerging economies is a promising research avenue to enhance our knowledge of operations management (Lee and Tang, 2017; Tang, 2018). The main theme of socially responsible supply chain literature is the creation of economic and social value through the incorporation of people living in the Base of the pyramid (BoP) to supply chains as suppliers or distributors (Sodhi and Tang, 2014). Therefore, supply chain partner continuity is also a relevant construct for this literature because it could provide insights on how focal firms could sustain the relationships with suppliers or distributors in the BoP.

The BoP business literature proposes that firms can be more profitable by serving the population which lives with less than 2 dollars (PPP adjusted) per day. However, this approach has been criticized because poor people are unable to develop capabilities that improve their economic conditions by purchasing affordable products and services (Karnani, 2007). Some scholars suggest that a better mechanism is to develop the capabilities of low-income population by integrating them in supply chains as suppliers or distributors. This observation bridges the literature of BoP business with SSCM. At this point, the common ground between these streams is the concepts of supply chain partner development; trustworthy, long-term relationships between multinationals, and BoP actors; and partner selection (Gold et al., 2013; Khalid et al., 2015). Both BoP business and SSCM fields of study emphasize the need to understand how focal firms in a supply chain develop the capabilities of other supply chain actors to stay in business for the long term.

Firms in the food and beverage industry must address several issues to be sustainable. For instance, the Global Reporting Initiative suggests that materials sourcing standards for biodiversity, soil management, GHG emissions, and water; packaging, energy consumption, waste management, consumer health and safety risks, local communities development are material aspects for this industry (GRI, 2013). Supply chain partner continuity is an integral mechanism through which focal firms in the supply chains generate socio-economic benefits to local communities. Since urban neighborhood shops is critical for the sustainability of food and beverage companies in emerging economies, this paper focuses on how focal firms contribute to neighborhood shops continuity for supply chain sustainability.

Distribution in the BOP context

Research initiatives in which the BoP population is incorporated as suppliers or distributors constitute an avenue for future research because most of previous studies have focused on initiatives in which the poor population were targeted as consumers (Kolk et al., 2014). Furthermore, Kolk et al (2014) also suggest that there is imprecision in the economic threshold for defining BoP population. Poverty lines vary if they are measuring rural or urban

population, or if they correspond to rich or poor countries. The World Bank has proposed the international poverty line at USD 1.90 PPP adjusted (2011 dollars), which is the measure for counting the people who live in extreme poverty (Ferreira et al., 2016). Furthermore, from 2017 the World Bank would also report the median poverty lines of middle income countries, and upper-middle income countries because achieving the same set of capabilities in different countries might require a different set of goods and services (Ferreira and Sanchez, 2017). Consequently, BoP business studies should specify the poverty line under which is the population of study.

There are few studies about socially sustainable or responsible supply chains (Beske and Seuring, 2014; Lee and Tang, 2017), and most of the research elaborated in this field have concentrated in the incorporation of BoP population as suppliers. On one hand, there are studies that focuses on suppliers' compliance to social standards, and on the monitoring schemes implemented by focal actors in the supply chain (Zorzini et al., 2015). On the other hand, there are studies adopting the collaboration approach with suppliers for social purposes. For instance, Distelhorst et al (2017) found that suppliers' training and education programs enhance the compliance to social standards. In this regard, capability-building interventions are a useful mechanism to create value, in the win-win sense, in socially sustainable supply chains (Lee and Tang, 2017).

Although previous research provides anecdotal evidence on how capability-building interventions are applied in sustainable distribution or micro-retailers programs (Lee and Tang, 2017; Tang, 2018), it is unknown whether this type of downstream supply chain practices contribute to micro-retailers' business continuity in urban low income neighborhoods. Thus, this paper follows an exploratory approach and aims to answer the following research questions: 1) how is supply chain partners' continuity conceptualized in the context of urban BoP micro-retailers?; and 2) does capability-building interventions by focal firms enhance BoP micro-retailers continuity?

Research design/ Methodology

This paper uses field work to explore the relationship between capability-building intervention and micro-retailers' business continuity. The research setting is the local program of a multinational beverage manufacturer in Ecuador. In 2017, the company sold about 500 millions of USD. 70% of the company's sales occur in the micro-retail marketing channel. The company distributed to approximately 100.000 micro-retails in Ecuador, and a high proportion of them are in low-income neighborhood.

This study only focuses on micro-retails that are in low-income neighborhood of Guayaquil. We chose Guayaquil because it is the largest city in Ecuador, and it has more than 50% of micro-retails in the whole country. The study has two stages. First, we undertook a qualitative study to understand the dynamics between the micro-retail and its environment. The driving question was to understand what risks and resources inhibit/enhance the business continuity of micro-retailers. The second stage of the study contains a survey to micro-retailers that have received the training program and micro-retailers in the same neighborhood that have not received the training program. Micro-retailers were not randomly chosen by the beverage manufacturer, so we have a quasi-experimental design of non-equivalent groups.

The qualitative part of the research was undertaken following a nested case study approach with two units of analysis. The first unit of analysis is the neighborhood, which is an area of 40-150 hectares delimited by the company. We chose three neighborhoods in terms of their sizes. A large (150 Ha) neighborhood with high density and commercial activity; a medium size neighborhood with high density and commercial activity; and a low size neighborhood with high density and commercial activities. In these neighborhoods live

low-income households, but there is heterogeneity between the inhabitants of the neighborhoods. The second unit of analysis is the micro-retail. We chose 4 to 6 retails in each neighborhood for in-depth interviews with the owners of the shop. The sampling of micro-retailers was based on the distance to main streets, the sales volume, and whether the micro-retailer entered in the training program. A total of 16 micro-retailers were interviewed.

Second, the authors would conduct a large-scale survey of micro-retailers in 5 low income neighborhoods of Guayaquil. The survey would gather data on the competences, risks, permits for the shop, and compliance with the law regarding the sale of alcohol, cigarettes, and the suggested prices by the manufacturer. Furthermore, secondary data about socioeconomic variables of the neighborhood would also be gathered. The secondary data would come from the National Socioeconomic Survey of Households. Finally, geographical data from the micro-retailers would also be obtained.

The empirical setting is the following. From May to October 2017 the beverage company invited about 4000 micro-retailers to a training program. The training program consisted in development of administrative skills (e.g inventory, bookkeeping), customer service, exhibition and product assortment to generate sales, and information about the procedures for obtaining the permits for the micro-retail. The training program consisted in three visits made by a trainer (about 1 hour per visit) in which the trainer went through the content and performed exercises to develop the skills. In addition, during the first visit the trainer delivered a book, a calculator and information about how the permits should be obtained. Also, during this visit the trainer performed an analysis of the status of the micro-retail in order to suggest improvements along the training program.

Since the company invited retailers who had already belonged to a loyalty program, we would perform a quasi-experimental design of non-equivalent groups (Shadish et al., 2002). A propensity score would be computed based on the years of experience of the micro-retailer, the density of retails around the micro-retailer, the distance to main roads, and the volume of sales. Then, based on the propensity score trained micro-retailers would be matched with non-trained micro-retailers.

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Information Sharing and Procurement Risk - Developing Measures for the Influence of Information and Communication Technologies on Procurement Risk

Rusch, Marc Alain Dennis, M.Sc.
University of Ulm, International Performance Research Institute
Königstraße 5, 70173 Stuttgart, Germany
E-Mail: MRusch@ipri-institute.com, Phone: +49 (711) 6 20 32 68-80 11

Summary
Manufacturing companies often possess incomplete information regarding the products they purchase. Information and communication technologies (ICT) enable companies to share greater quantities of information with suppliers in a short period of time, giving them an opportunity to overcome such problems. Based on Organizational information processing theory (OIPT), a theoretical framework is developed, explaining the influence of ICT usage on procurement risk. Two conclusions are drawn from this paper. First, ICT usage influences procurement risk indirectly by effecting the amount of information shared. Second, the strength of this effect depends on specific characteristics of the procurement situation.

Key words: information sharing, procurement risk, OIPT
Submission category: working paper
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Context and research question

The information sharing problem

The impact of a manufacturing company's procurement activities on overall performance has increased substantially over the past decades. The main reasons for this are high outsourcing rates and the correspondingly high amount of products purchased by such companies. As a consequence, manufacturing companies need to increase the cooperation with suppliers, which at the same time increases supply chain complexity. This in turn leads to the occurrence of procurement risks, which may prevent a purchasing company to fulfill its overall procurement targets: receiving the right amount of products and services at the right quality and to the right time while paying the right price (Wannenwetsch, 2014; Schuh and Hoppe, 2013; Kreuzpointner and Reißer, 2006).

Manufacturing companies often possess incomplete information regarding quantity, quality, delivery date and price of the products they purchase, resulting in unachieved procurement targets (Busse et al., 2017). Extensive information sharing with suppliers might be a solution to overcome procurement risk (Busse et al., 2017). Information sharing within a supply chain is implemented using information and communication technologies (ICT) (Gleich et al., 2016), which enable companies to share greater quantities of information with suppliers in a short period of time and generally lead to improved procurement activities (Gardenal, 2013; Eei et al., 2012).

A high degree of information sharing might, however, not be appropriate in every procurement situation (Kolmykova, 2016; Stoll, 2008). On the one hand, extensive information sharing with suppliers requires substantial investments in ICT. On the other hand, companies ought to consider different security aspects, especially when sharing sensitive data within a supply chain. Hence, a high degree of information sharing with suppliers should only be established in such procurement situations, in which procurement risk can actually be decreased. The degree of information sharing a company engages in is dependent on specific characteristics of the procurement situation (Kolmykova, 2016).

Research question and motivation of this paper

The aim of this paper is to develop a theoretical framework that explains the influence of ICT usage on procurement risk. By doing so, this paper answers the following research question: How does ICT usage influence procurement risk?

The motivation of this paper is to give detailed view on ICT usage in supply chains by analyzing how the use of different kinds of ICT influences the amount of different types of information shared and how, in turn, this influences procurement risk.

Literature review

Information sharing in supply chains

Information sharing has become one of the major topics within supply chain literature. The topic is often discussed in terms of supply chain integration, in which information sharing is considered one of three integration aspects, the others being operation and relation (Leuschner et al., 2013). Supply chain integration literature generally discusses the level of integration between different members of a supply chain and its effect on firm performance. Literature mostly depicts a positive relation between supply chain integration and different company and supply chain performance metrics such as efficiency and effectivity (Leuschner et al., 2013; Schoenherr and Swink, 2012; Flynn et al., 2010; Yeung et al., 2009; Wang et al., 2006).

Information sharing, as part of supply chain integration literature, focuses on how members of a supply chain communicate, which types of information they share with each other and which effect this has on performance (Srinivasan and Swink, 2015; Zand et al., 2015; Montoya-Torres and Ortiz-Vargas, 2014; Huo et al., 2014). Thereby, different types of information that can be shared are considered and analyzed, mainly in terms of dyadic supply chains (either from a buyer's or a supplier's point of view).

However, while analyzing the effects of information sharing on performance metrics, the focus usually lies on single types of information, e.g. inventory levels or demand forecasts. More recent literature reviews give a broad overview of types of information that can be shared. Huang et al. (2003) review literature focusing on the impacts of sharing production information on supply chain dynamics. Montoya-Torres and Ortiz-Vargas (2014) review literature regarding possible types of information analyzed in literature, identifying six key types of information that can be shared (related to product, process, inventory, resource, order and planning), indicating that literature should focus more heavily on the effects of full information sharing. To the best of our knowledge, no paper incorporates all relevant types of information that can be shared. Moreover, information shared by the buying as well as the supplying side needs to be considered in such analyses simultaneously.

ICT usage

Related to aspects of information sharing in supply chains is literature regarding ICT usage. The focus hereby lies on how information is actually shared amongst members of a supply chain. Again, different aspects of this are considered in literature. One major topic is which technologies are used to share information with respect to different organizational settings (Schöning, 2006; Mieke, 2006). Another important area of research is how ICT usage adds value to a company (Kohli and Grover, 2008; Melville et al., 2004). Known as the „productivity paradox", a large number of studies shows that investments in ICT have no positive influence on firm performance (Zimmermann, 2013; Schryen, 2010; Brynjolfsson, 1993). However, more recent studies usually confirm that there is indeed a positive influence of such investments on firm performance, even though the implementation of ICT is associated with substantial costs (Zimmermann, 2013; Tallon and Pinsonneault, 2011; Gorla et al., 2010; Stratopoulos and Dehning, 2000; Dedrick et al., 2003; Melville et al., 2004).

ICT usage by a company's procurement function is generally discussed under the topic of e-procurement (Schuh et al., 2013; Essig and Arnold, 2001; Stoll, 2008). Since the

implementation of ICT is associated with substantial costs, scholars try to depict in which ways this has a positive influence on the performance of the procurement function. Examples are increased transparency due to higher information quality and quantity, or increased overall efficiency due to shorter lead times (Gardenal, 2013). In general, the influence of ICT on procurement performance is regarded as a positive one (Eei et al., 2012; Croom and Brandon-Jones, 2007; Presutti, 2003; Yen and Ng, 2003), even though most authors don't differnciate between effects of different types of supply chain technologies. Moreover, the degree of ICT usage as well as the degree of information sharing a company engages in is dependent on the procurement situation (Kolmykova, 2016), which is generally not considered in recent analyses.

Research gap

As discussed above, recent literature shows that information sharing as well as ICT usage have gernerally a positive effect on supply chain performance. However, no study incorporates all relevant types of ICT and types of information that manufacturing companies share with each other. In this sense, this study measures how using different types of ICT effects the degree of information sharing for different types of information. Thereby, a broad number of types of information is considered. Finally, the influence of sharing these different kinds of information on supply chain performance is measured. As a measure of performance, the reduction of risk is used, which is discussed later. The overall aim of this research is to extend existing literature by giving a complete picture of ICT usage and information sharing amongst manufacturing companies and their influence on supply chain performance.

Development of a theoretical framework

Organizational information processing theory

The theoretical background informing this paper is Galbraith's (1973; 1974) organizational information processing theory (OIPT), which explores and stresses the importance of information processing in organizations. By doing so, Galbraith draws one important conclusion from contingency theory, namely that there is no one best way to organize information sharing amongst organizations, but that the organization of information processing is rather dependent on organizational characteristics (Galbraith, 1973). When conducting organizational tasks, companies face uncertainty, which Galbraith defines as "the difference between the amount of information required to perform the task and the amount of information already possessed by the organization" (Galbraith, 1973). An effectively organized information processing helps to minimize uncertainty (Srinivasan and Swink, 2015).

In order to reduce uncertainty, companies need to reduce the gap between their information processing needs and their information processing capabilities. There are two strategies to align these two: A company can either reduce the amount of information required, hence lower the information processing needs, or it can increase its information processing capabilities (Zand et al., 2015; Qrunfleh and Tarafdar, 2014; Wong et al., 2011). Information processing capabilities can generally be increased by using ICT (Premkumar et al., 2005).

OIPT has different implications for this research. First, according to OIPT, information sharing decreases uncertainty and risks associated with uncertainty. With regard to a company's procurement activities, risk is reflected in a deviation of one of the following: quantity, quality, delivery date, and price. Information sharing itself is two-sided and consists of information provided by the buyer and information provided by the supplier. Both types of information flow affect procurement risk. Second, the use of information systems, either by the buyer or by the seller, affects information sharing. Third, and in line with contingency theory, the effects of ICT usage and information sharing procurement risk are moderated by the amount of uncertainty related to a specific procurement situation. According to OIPT, the degree of uncertainty depends on two factors. These are subunit task characteristics, represented by the

complexity of the procurement task, and the subunit task environment (Tushman and Nadler, 1978; Galbraith, 1973; Schoenherr and Swink, 2012).

Network theory

Even though OIPT discusses information processing problems in general, its focus lies on internal information processing problems and information sharing within a supply chain is not explicitly explained (Busse et al., 2017). Hence, while subunit task characteristics are explained by OIPT as an internal source of uncertainty, the theoretical basis of this research needs to be extended by a theory that discusses subunit task environment with regard to supply chains. Consequently, network theory is applied in order to explain the relationship between different entities (people or organizations) and the impact of these relationships (Ebers and Maurer, 2014; Granovetter, 1983). Network theory identifies the dominant factors influencing the behavior of organizations as well as the outcome of that behavior. These factors are the strength of the partners' relationship and the structural position of each partner within the network (Ebers and Maurer, 2014; Newbert et al., 2013; Adler and Kwon, 2002).

Network theory has different implications for this research. As discussed before, network theory describes the characteristics of the subunit task environment. Subunit task characteristics and subunit task environment constitute the characteristics of the procurement situation. In line with OIPT, the effects of ICT usage and information sharing on procurement risk are moderated by these factors. Subsequently, the term "task characteristics" is used to describe the procurement task, while subunit task environment is divided into the terms "relationship characteristics" and "environmental characteristics" (which describes structural position of each partner within the network).

Development of the theoretical framework

Before the overall theoretical framework is developed, procurement risk needs to be explained in more detail. Risk can be defined as a deviation from target values (Diederichs, 2013). As discussed before, in this analysis procurement risk is defined as not fulfilling a company's overall procurement targets: receiving the right amount of products and services at the right quality and to the right time while paying the right price. Hence, risk means a deviation from the defined taget quality, quantity, delivery date and price of the purchased goods (Zitzmann, 2015; Thiemt, 2003). In other words, in this study risk is defined in terms of supplier performance: this study suggests that increased ICT usage reduces the risk of deliveries by the supplier that don't meet the agreed upon conditions.

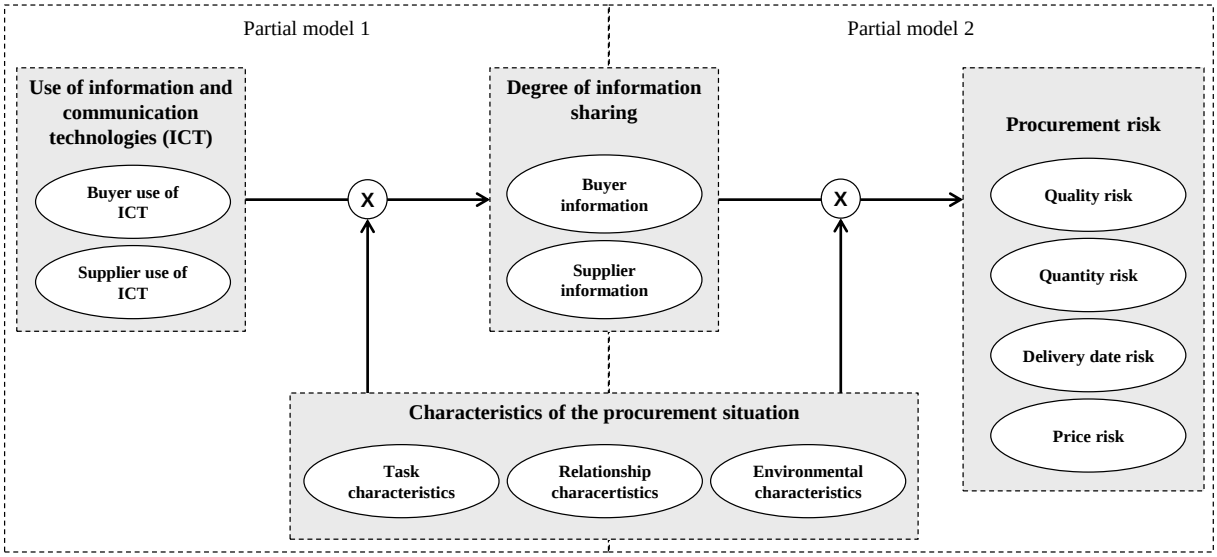

Figure 1: Theoretical framework

Figure 1 shows the theoretical framework which is derived from OIPT in combination with network theory. As discussed by OIPT, ICT usage has an indirect effect on procurement risk, as it influences the degree of information sharing. The degree of information sharing directly influences procurement risk. As a consequence, the framework is divided into two partial models, both of which need to be analyzed with regard to the characteristics of the procurement situation. As the theoretical framework shows, ICT usage influences procurement risk indirectly by effecting the amount of information shared. Moreover, the strength of this effect depends on specific characteristics of the procurement situation.

Construction of measures

Independent variables

As the theoretical framework in figure 1 shows, ICT usage, the degree of information sharing as well as the characteristics of a procurement situation need to be taken into account as independent variables. Each corresponding measure is discussed in turn, starting with the degree of information sharing, as different types of information that can be shared need to be discussed first. A large amount of studies focuses on single (or only a few) types of information that are shared within a supply chain, most commonly demand forecasts (e.g. Yan et al., 2016; Costantino et al., 2014; He et al,. 2014), inventory levels (e.g. He et al., 2014; Huo et al., 2014), production plans and production capacities (e.g. He et al., 2014; Huo et al., 2014; Lotfi et al., 2013) as well as order information (e.g. Shang et al., 2015; Lotfi et al., 2013). Table 1 gives an overview of recent literature and the corresponding types of information accounted for. In total, eighteen types of information are identified.

Table 1: Types of information shared with suppliers

■	Type of information	References
1	demand forecast	Yan et al. 2016; Costantino et al. 2014; Huo et al. 2014; Montoya-Torres and Ortiz-Vargas 2014; He et al. 2014; Lotfi et al. 2013; Datta and Christopher 2011; Yu et al. 2010; Klein and Rai 2009
2	inventory level	Huo et al. 2014; Montoya-Torres and Ortiz-Vargas 2014; He et al. 2014; Datta and Christopher 2011; Yu et al. 2010; Kelle and Akbulut 2005
3	(production/delivery) lead time	Montoya-Torres and Ortiz-Vargas 2014; Lotfi et al. 2013; Kelle and Akbulut 2005
4	production plans	Huo et al. 2014; Montoya-Torres and Ortiz-Vargas 2014; He et al. 2014; Klein and Rai 2009; Kelle and Akbulut 2005
5	inventory policy	Lotfi et al. 2013; Klein and Rai 2009
6	point of sales data	Huo et al. 2014
7	production capacity	Huo et al. 2014; He et al. 2014; Lotfi et al. 2013; Yu et al. 2010
8	sales promotion and marketing strategies	Klein and Rai 2009
9	shipment information	Montoya-Torres and Ortiz-Vargas 2014; Lotfi et al. 2013; Ortiz-Vargas and Montoya-Torres 2012
10	cost structures	Montoya-Torres and Ortiz-Vargas 2014; Lotfi et al. 2013; Klein and Rai 2009
11	product/services in development	Klein and Rai 2009
12	order status	Kelle and Akbulut 2005
13	production quality	Kelle and Akbulut 2005; Tsung 2000
14	product structure/quality	Montoya-Torres and Ortiz-Vargas 2014; Tsung 2000

■	Type of information	References
15	batch size	Ortiz-Vargas and Montoya-Torres 2012
16	production status	Kelle and Akbulut 2005
17	order information	Montoya-Torres and Ortiz-Vargas 2014; Lotfi et al. 2013; Yu et al. 2001
18	changing needs	Son et al. 2015; Li and Lin 2006

In order to draw a complete picture, all eighteen types of information are taken into account when measuring the degree of information sharing. One might measure the degree of information sharing as the percentage of total information shared. However, this would not give an indication about the actual amount of information shared. To overcome this problem, the degree of information shared is measured as the average interval (number of days) between two reports. This is essentially a measure for the quantity of information shared. This is measured for each type of information separately, rather than calculating one overall value for "degree of information sharing" (resulting in 18 variables). Also, the variables should be measured for buyers and suppliers separately.

Second, and in line with Bensaou and Venkatraman (1995), ICT usage might be measured as a dichotomous item, indicating whether each type of information is exchanged in electronic form or not. To expand on this, the type of technology used to exchange information is taken into account. The following technologies are integrated into the analysis: telephone, e-mail, electronic data interchange, extensible markup language, web-based electronic data interchange, supplier portals, cloud computing (Kolmykova, 2016; Stoll, 2008; Premkumar et al., 2005). ICT usage is measured on a nominal scale, indicating which type of ICT is used most frequently to exchange information between a buyer and a supplier.

Third, measures for characteristics of the procurement situation are constructed. Task characteristics are represented by the complexity of the procurement task. The complexity is rated using a combination of the value of the underlying goods (high/intermediate/low) and their consumption rate (constant/fluctuating/unsteady) (Piontek, 2016). In general, the lower the value of the underlying goods and the more constant the consumption rate, the less complex a procurement task is (measured as either high, intermediate, or low).

Relationship characteristics are represented by four different variables: duration of the relationship (number of days; Newbert et al., 2013), interaction frequency (average number of days between two interactions; Newbert et al., 2013), multiplexity (number of different products ordered by the buyer; Newbert et al., 2013), emotional intensity (using again four items, measured a seven-point scale, taken from Fang, 2011). The items to measure emotional intensity are as follows: (1) Both parties feel indebted to each other for what we have done for each other, (2) In this alliance, we share close social relations with each other, (3) The relationship between both parties can be defined as "mutually gratifying", (4) Both parties expect that we will be working together far into the future.

Following the discussion by Ebers and Maurer (2014), the structural position of the supply chain members is represented by three different variables: number of alternative buyers/suppliers (as discussed by Murray et al., 1995), number of alternative products (as discussed by Murray et al., 1995), and presence of structural holes, which is measured using the number of buyers a supplier possesses and vice versa (as discussed by Ahern, 2012).

Dependent variables

Finally, a measure for procurement risk is constructed, dividing overall procurement risk into four categories: quality risk, quantity risk, delivery date risk and price risk. Quality risk is measured using the number of rejected goods due to quality issues divided by the total number of deliveries. Similarly, quantity risk is measured using the number of rejected goods due to quantity issues divided by the total number of deliveries. Delivery date risk is measured using

the number of deliveries that didn‘t meet the scheduled delivery date divided by the total number of deliveries. All three measures are based on measures proposed by Piontek (2016). In addition, price risk is measured using the number of deliveries that didn‘t meet the agreed price divided by total number of deliveries.

Conclusion and outlook

As discussed in this paper, information sharing by using ICT can be an effective way for manufacturing companies to decrease procurement risk. This analysis identifies implications for buying companies in order to decrease procurement risk with respect to specific procurement situations. Two major conclusions can be drawn from this paper. First, ICT usage influences procurement risk in an indirect way. ICT usage influences the degree of information shared between two supply chain partners. The degree of information shared in turn influences procurement risk, which can be divided into quality risk, quantity risk, delivery date risk and price risk. Second, in order to measure this influence, ICT usage, the degree of information sharing, the characteristics of a procurement situation as well as procurement risk need to be taken into account. When measuring the degree of information sharing between buyer and supplier, all relevant types of information need to be taken into account. In this paper, eighteen types of information are identified. For all variables, corresponding measrues are proposed in this paper.

To give a brief outlook, the proposed measures (except for procurement risk) are used in a questionnaire for data collection. The questionnaire is sent to German manufacturing companies and their corresponding suppliers. Data regarding the proposed measures for procurement risk are taken out of the databases of the respective buying companies. Data collection will take place in the second half of 2018. This analysis is part of the author’s doctoral dissertation. The results of this analysis will be published within the scope of a monograph.

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The effects of structural complexity of Multinational Corporations (MNCs) on Purchasing Organization

Sudipa Sarker
Assistant Professor
Department of Industrial and Production Engineering
Bangladesh University of Engineering and Technology
Dhaka-1000, Bangladesh
Email: sudipasarker@gmail.com

Paolo Trucco
Full Professor
Department of Management, Economics and Industrial Engineering
Politecnico di Milano, 20133 Milan, Italy
Email: paolo.trucco@polimi.it

Andreas Feldmann
Assistant Professor
Department of Industrial Economics and Management
KTH Royal Institute of Technology, 10044 Stockholm, Sweden
Email: andreas.feldmann@indek.kth.se

Abstract
For years, purchasing organizations have been conceptualized to take the form of centralization, decentralization or hybrid organizations. However, scholars have also registered a choice among each form is not that straightforward. This paper takes this discussion to the next level and purports that understanding of internal structural complexity of purchasing organizations is important before deciding on suitable form of it. Anchored in two Swedish Multinational Corporations and the theoretical lenses of bounded rationality and contingency theory this paper sheds light on why such choices among three forms are difficult by the demonstrating the effects of structural complexity on purchasing organization.

Keywords: Organization Complexity, Supply Management, Category Management

Introduction:
Researchers have acknowledged about a clear trend of continually increasing outsourcing and global sourcing activities of Multinational Corporations in the recent past. This is because both global sourcing and outsourcing strategies come with some difficult to overlook benefits such as cost reduction, increased quality and availability of purchased materials as well as an increased focus on core competencies for these MNCs (Cho & Kang, 2001; Jiang, Belohlav, & Young, 2007). However, one of the key challenges faced by MNCs for practicing global sourcing and outsourcing strategies is disintegration of purchasing units all over the world. As a result, integration and coordination of these dispersed purchasing units become problematic (Rozemeijer, van Weele, & Weggeman, 2003; Sarker, Azadegan, & Trucco, 2017).
Over the years, researchers have responded positively to these problems of large global corporates. As a result, the research on purchasing organization (PO) has flourished. One of the key areas of research on purchasing organization is its structure. The structure of purchasing

organization has been studied on three accounts (Glock & Hochrein, 2011). First, authors have conceptualized centralized, decentralized, or hybrid forms of PO and delineated the impact of each form on the efficiency of the purchasing process (Arnold, 1999; Corey, 1978). Second, researchers have identified the factors internal or external to the organization that facilitate the choice of the right form of PO (Bals, Laiho, & Laine, 2014). Third, authors have studied each form in various industries (Johnson, Leenders, Flynn, & Flynn, 2011). This research falls under the second domain and concentrate on the factors internal to the MNCs that may affect the choice among centralized, decentralized or hybrid forms of PO.

The guiding research question for this article is how internal structural complexities of MNCs effects the purchasing organization. For this research, purchasing organization is conceptualized to be comprised of multiple purchasing units of MNCs that are dispersed across the globe and internal structural complexity is defined as horizontal, vertical and spatial complexities (Hall, 1992). In this regard, horizontal complexity is referred to the differentiation among purchasing units at the same level. Vertical complexity is defined as the differentiation of tasks (roles) at different hierarchical levels and spatial complexity encompasses geographical dispersion of the purchasing units (Price, 1997).

In order to understand the effects of the internal structural complexity, this research uses theoretical underpinnings of contingency bounded rationality (H. A. Simon, 1955) and contingency theory (Fiedler, 1967).

point forward, this article is structured as follows. The theoretical perspective section outlines underpinnings of bounded rationality and contingency theory adopted for this research. The methodology section discusses case study method adopted for this research. The results section presents the different roles and contexts of the studied cases. In the discussion section, effects of internal structural complexities of MNCs are illustrated using the guidance of contingency theory and bounded rationality. Conclusion section sheds lights on the limitations of this research and provides recommendations for future research.

Theoretical Perspectives

Bounded rationality

In this paper, bounded rationality is used as a standalone lens following the guidelines of Allison (1969), who have utilized it to analyze the decisions during Cuban Missile Crisis. Though use of bounded rationality as a standalone lens to understand supply chain problems is also rare in purchasing and supply chain management (P&SCM) literature. However, as many popular organizational theories that are frequently used by P&SCM researchers, have bounded rationality as underlying assumption (Halldorsson, Kotzab, Mikkola, & Skjoett-Larsen, 2007). Hence, bounded rationality is not an alien perspective to be used for analyzing P&SCM problems.

The term “bounded rationality” was first introduced by Simon (1955), who argues that the decision making capabilities of organisms (e.g., people in organizations) are limited or bounded by two things: first, access to information and, second, information-processing capability or cognitive limitations. Extending this thought, Sarker et al. (2016) purports that roles in organizations are excellent predictor of the type of information gathered by the people performing those roles. The authors contended that “internal visibility” of organizational members are limited by the roles and responsibilities or tasks that they are required to perform to their job done. A similar line of thought is adopted in this paper. Consequently, roles of purchasing professionals from two MNCs were analyzed in order to understand the effects of internal structural complexity of MNCs.

Contingency theory

Unlike bounded rationality lens, P&SCM literature is deeply rooted in the contingency paradigm (Sousa & Voss, 2008; Spina, Caniato, Luzzini, & Ronchi, 2013). Scholars in the field has utilized contingency theory to study corporate purchasing synergy (Rozemeijer et al., 2003), purchasing department structure (Stanley, 1993), internal visibility (Sarker et al., 2016) and so on.

Contingency theory builds on two core assumptions. First, there is no "one" best way to organize. Second, no single way of organizing is equally effective in all situations (Fiedler, 1967). Based on the above assumptions, contingency theorists suggest that organizations must adapt their structures to fit their internal and external environment (Lawrence & Lorsch, 1967). To achieve the desired fit, integration and differentiation of tasks can be created (Galbraith, 1973). Differentiation means organizing each sub-task in a manner that enables effective performance of those individual subtask. Integration means creating links between differentiated sub-tasks to ensure successful completion of the whole task. To understand environment, contextual variables must be identified (Donaldson, 2001).

In this paper, contingency theory serves the purpose of explaining the effects of internal structural differentiation of the MNCs due to the diversity of their contexts. Contextual variables such as strategic sourcing environment and technology that already identified by researchers in field (Schoenherr, Modi, Talluri, & Hult, 2014; Stonebraker & Afifi, 2004) are used to describe contexts.

Methodology

Case study design provides a rich understanding of the empirical world (Flyvbjerg, 2006). The case study design is considered suitable for this paper because it can provide in-depth insights on effects of internal structural complexity on purchasing function. The following section describes the cases studied for this research.

Cases

The empirical data for this research were collected from two Swedish MNCs. A brief description of each case is presented on Table 1. Table 1 reveals few important factors about cases. First, both the organization are well established, large and have existence in a number of countries of the world. Case-I is a world-leading key and lock manufacturer. Founded in 1994, it has grown from a small regional company to a large group of over 200 companies in 20 years. The organization has 43,000 employees and operates in 70 countries. The product range includes mechanical, electromechanical, and electronic products. The supply base of case-I has 8700 direct material suppliers. On average, the case organization sources 60% of its sales volume from its suppliers

Table 1: An overview of the cases

Attributes	Case 1	Case 2
Founded in the year	1994	1890
Size (no. of employees)	43,000	110,000
Operates in	70 countries	180 countries
Industry	Key and lock manufacturer	Network solutions for the telecom industry
Sector	Manufacturing	Service
Typical categories	Lock cases, electronics, aluminium, machining, casting, etc.	Patent, electronic components, real estate, power, etc.

Sales to sourcing percentage	60%	60%
No of suppliers	8700 (only direct material suppliers)	28000 (direct and indirect material suppliers)

Case II is the largest supplier of mobile telecom systems in the world. Founded in 1876, the organization currently employs approximately 110,000 people in more than 180 countries. The key product of the organization is mobile networks representing 55% of sales value. However, it is also a strong player in providing services (40% of sales value) to the telecom industry and in developing support solutions for TV and media. The organization has 28,000 suppliers. Depending on the product category, the value of sourcing ranges from 50% to 90% of the sales value. On average, the organization sources 60% of its sales value from suppliers.

Data collection

The data collection efforts in the two cases are presented in Table 2. The primary method of data collected was semi-structure interview. The aim of the interview was to understand their roles and contexts of operation. Eighteen (18) sourcing professionals of case-I who are positioned all over the world are interviewed over a period of 8 months. Phone interviews were conducted for respondents located outside Sweden and for respondents located within Sweden face to face interviews were performed.

Table 2: Overview of data collection in the cases

Attributes	Case-I	Case-II
Duration of attachment	8 months	3 months
Number of respondents	18	18
Respondent profiles	Supply management professionals, sustainability managers, category managers, sourcing directors, purchasing managers	Head of network sourcing, supplier relationship managers, category managers, category leads, category heads
Documents	88 (internal and external: presentation, risk reports, sustainability reports, annual reports)	20 (external: annual reports, presentations available on the website, masters' theses)

For case-II, similar questions are repeated among eighteen 8 sourcing professionals to gains insights into their roles and contexts. As for case II, all the sourcing professionals were located in Sweden, the interviews are contacted face to face. Average duration of interviews for both cases were one and half hours. With the exception of one or two respondents from each case, all the interviews are recorded.

The secondary source of data was internal and external organization documents that were collected during and after the interviews. For case-I, 88 of such documents were collected from the website and the respondents. For case-II, the number of documents collected was 20.

Data analysis

Because of the qualitative nature of the gathered data it was subjected to content analysis (Dooley, 2016). Recorded materials were transcribed verbatim. The transcribed interviews as well as the documents were thoroughly read by the authors. The principle concern was to

understand the effects of internal structural complexity based on the theoretical underpinnings of bounded rationality and contingency.

Findings

Internal structural complexity

For Case-I, the horizontal complexity is embodied in the five divisions at the same level. The vertical complexity is embodied in the three hierarchical levels, i.e., the group, divisional, and entity levels (e.g., manufacturing units and company). The spatial complexity is characterized by the geographical spread of the organization in different regions. Regional divisions A, B, and C operate in the geographical areas of the Americas, Europe, and Asia Pacific, while product divisions E and F operate globally.

In comparison, the horizontal complexity for case II results from 120 product categories. Similar to case-I, the vertical complexity is embodied in three organizational levels, i.e., corporate, divisional, and regional levels. The spatial complexity is embodied by 10 regions across the globe that manages site offices in 180 countries.

Purchasing organizations

The purchasing function is referred in case-I as supply management which is a corporate-level function. The chief technology officer (CTO) is positioned at the top of the purchasing organization. The group supply chain director (GSCD) is next in the line of command. These two top managers are positioned at the corporate headquarters. The next responsible managers in the purchasing organization are positioned in the five divisions spread across the world. These five divisions are decentralized and have divisional sourcing directors as head of these divisions. These managers are responsible coordinating purchasing function within the divisions. The next line of command who reports to these divisional managers are the category managers. Category managers are reported by the purchasing managers who are positioned at individual entities such as a manufacturing plants or service offices. Figure 1 depicts the purchasing organization for case-I.

Figure 2, depicts purchasing organization for case-II. Similar to case-I, Purchasing is a corporate-level function for case-II. However, the function of purchasing is referred in the organization as sourcing. In contrast to case-I, purchasing organization is centralized for case -II. Vice president of network sourcing is positioned at the top of purchasing organization. Head of network sourcing is next to follow. This level is regarded as corporate headquarters level.

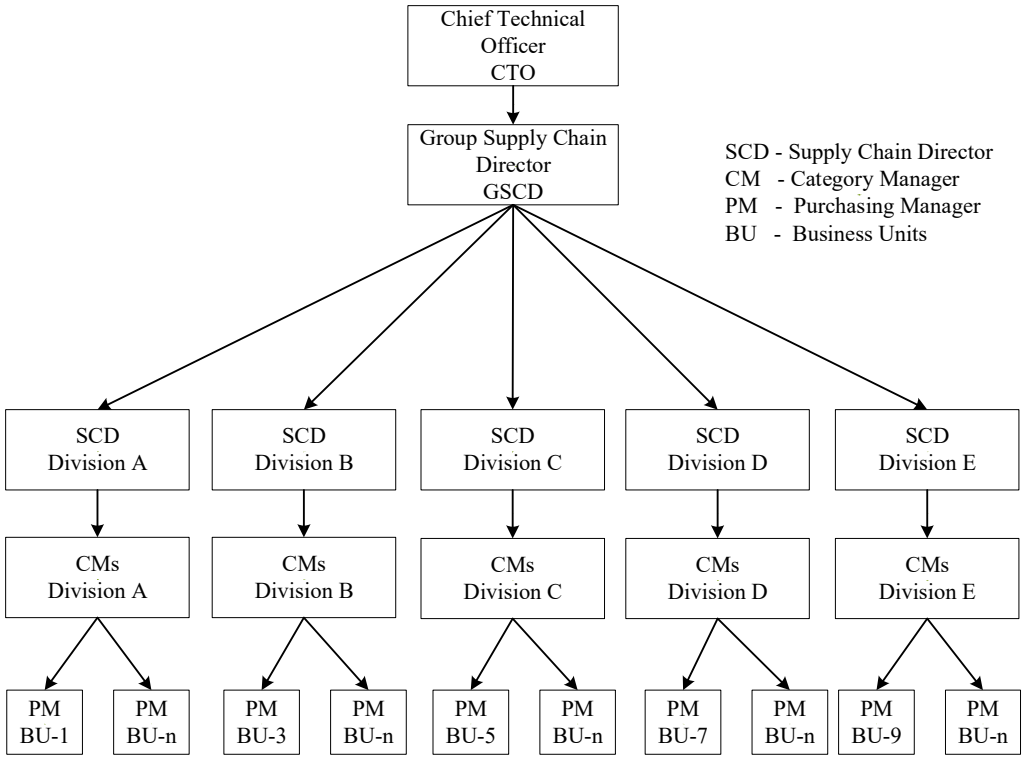

Figure 1: Purchasing Organization of Case-I

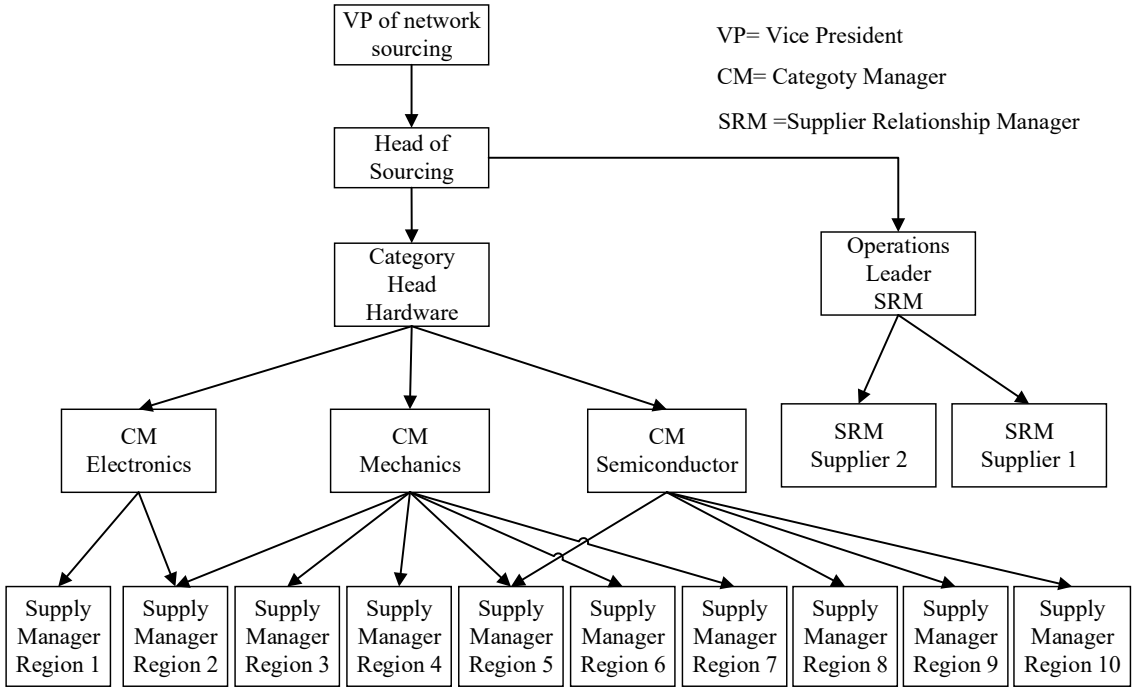

Figure 2: Purchasing Organization of Case-I

The next responsible managers in the purchasing organization are positioned at the level where categories are managed. Several managers are positioned at this level, for instance, the head of network sourcing, category leaders, category managers, operational leader for supplier

relationships, supplier relationship managers, and sourcing managers. Category leads, category managers, and sourcing managers works in a team and updated by the supply managers who are positioned at 10 regions around the world.

Roles in the purchasing organization

Table 3 and Table 4 describe different roles of purchasing professionals in case-I and case-II respectively.

Table 3: Roles of supply management professionals in case-I

Levels	Roles	Description of the role
Group level	Chief technology officer (CTO)	To lead supply management function of the group
	Group supply chain director (GSCD)	To align supply management functions of five divisions
	Group supplier quality and sustainability manager	Is responsible for carrying out sustainability audits in manufacturing units
Divisional level	Sourcing directors	Developing long term sourcing strategies
	Category managers	Developing category strategies
Entity level	Purchasing managers	Source items, raise request for quotation, issue purchase order

Table 4: Roles of sourcing professionals in case-II

Levels	Roles	Description of the role
Group Level	VP network sourcing	Responsible for the long-term development of Strategic Sourcing
	Head of network sourcing	Responsible for leading the sourcing organization
Category level	Category lead	Developing category strategy and aligning it to Supplier Relationship Management House
	Global category manager	Develop best strategies for the category and have a supplier list that fulfils organization's needs for three to five years
	Category manger	Define category strategy and decide on supply base for the category
	Operations leader- supplier relationship management	Manage and lead the supplier relationship management function
	Supplier relationship manager	Manage suppliers important large suppliers for a particular category
Regional Level	Supply manager	Creating request for quotation, checking quality and delivery of incoming materials.

Table 3 depicts that for case-I, roles are different and hierarchical i.e. GSCD reports to CTO and group supplier quality and sustainability manager reports to GSCD in the group level. In, the divisional level, two prominent roles of purchasing organization of case-I are sourcing director and category manager which is same across the five divisions. Similarly, roles of purchasing managers who are positioned at a manufacturing unit are same as purchasing manager at other manufacturing units.

Table 4 depicts that for case-II, roles are again different and hierarchical i.e. head of network sourcing reports to vice president of network sourcing. For category level (similar to divisional level for case-I), there are a number of roles that are similar for different categories. All-important categories had roles such as category leads, global category managers and category managers. Important suppliers within the category had supplier relationship managers. At the regional level, supply managers are responsible for request for materials as per requirement of the regions and checking the quality and delivery of the incoming materials.

Contexts in the purchasing organization

Table 5 presents different contexts of purchasing professional of case-I at all three levels and across various divisions.

Table 5: Contexts of supply management professionals in case-I

Levels	Roles	Technology	Strategic Sourcing Environment
Group level	Chief technology officer (CTO)	Product portfolio of mechanical, electromechanical locks, electronic IDs and entrance solutions for hospitals, garage, stadiums.	Having a world class supply base that is innovative and sustainable
	Group supply chain director (GSCD)		
	Group supplier quality and sustainability manager		
Divisional level & Entity level	Sourcing and category managers of Division A	Mechanical locks, lock systems and fittings, 46 %; Electromechanical and electronic locks, 14%; Security doors and hardware, 40%	Category Lock case - Large, but extremely concentrated (2% of the suppliers' cover 80% of the spend)
	Sourcing and category managers of Division B	Mechanical locks, lock systems and fittings, 60 %, Electromechanical and electronic locks, 26 % Security doors and hardware, 14 %	Category Lock set - Large considering the spend, but concentrated (15% of the suppliers' cover 80% of the spend)
	Sourcing and category managers of Division C	Mechanical locks, lock systems and fittings, 53 % Electromechanical and electronic locks, 9 % Security doors and hardware, 38 %	Category Stamping - Large, but concentrated (13% of the suppliers' cover 80% of the spend)
	Sourcing and category managers of Division D	Automatic doors, industrial doors and docking systems product 65%, Services 35%	Category - Electronics High supplier power, low buying power, due to competition from other industry sector
	Sourcing and category managers of Division E	Access control, 48% Identification technology, 29%	Category stainless steel : 80% are generic having large number of sources, 20% are tailored having one source

Following Schoenherr et al. (2014) and Stonebraker & Afifi (2004), contextual factors are presented in table 5 on two regards: strategic sourcing environment and technology. At the group level, contextual factors are created by nature of product i.e. mechanical, electro-mechanical locks and corporate strategies such as innovation and sustainability. At the divisional levels contexts varied across division as well as within a division. Variation of contexts among division was either due to different types of product/ technology or due to different categories. For instance, for divisions A, B and C, products were similar. However, purchasing situations were very different for different categories (e.g. lock set, lock case and stamping). For divisions D and E, the products (e.g. electronic ids and entrance solutions) are different than that of division A, B, and C. The categories are also different for division D and E from other three divisions.

Table 6 depicts various contexts of sourcing professionals for case II. Again, the contexts are presented on two regards: technology and strategic sourcing environment.

Table 6: Contexts of supply management professionals within the organization

Levels	Roles	Technology	Strategic sourcing environment
Group Level	Head of group sourcing	Industry growth only 2% A downward economy Cut through competition	Creating the highest value from supplier by balancing risk, cost and flexibility
	VP Sourcing		
Category level	Category lead	Patent	Slow category Suppliers are law firms with lots of local regulations.
	Global Category Manager	Electronics	Differs significantly for different countries Many single source suppliers
	Global Category Manager -	Site installation material	Powerful suppliers with factories all over the world Suppliers are buying out each other
	Category manger	Site sourcing	Long tail of suppliers
	Category manager	Temporary works	White collar consultants spreading over 90 countries
	Supplier relationship manager	Logistic	An important category spend in one supplier is 2 billion dollars
	Supplier relationship manger	Electronics manufacturing services	Outsourced manufacturing to a third supplier
	Supplier relationship manager	Consultancy	Lots of non-critical suppliers
	Supplier relationship manger	Software & systems	Critical supplier, difficult to swicht

Due to product nature of case II, at the group level, the contexts entailed slow industry growth and high competition as well as corporate strategy of creating value through suppliers. For category level, contexts varied with different categories as well as nature of supplier within a category. For instance, category of patent was a slow category with local law firms of a particular country as the supplier. In comparison, category of logistics had big suppliers with a global presence. Category of consultancy was significantly different than that of software &

systems with regards to criticality of suppliers. In table 6, regional level is missing because they were not purchasing anything rather just raising request for quotation for manufacturing units within the region.

Discussion

This paper sets out to understand the effects of internal structural complexity (e.g. vertical, horizontal, and spatial) on purchasing organization. In order to understand the effects purchasing organizations of two MNCs were studied. This section discusses the effect of each complexity on purchasing organization through the lens of bounded rationality and contingency theory and put forward the implications of such effects.

Table 7 synthesize the effects of internal structural complexity according to the guidance of bounded rationality and contingency theory.

Table 7: Effects of structural complexities as explained by bounded rationality and contingency theory

Theories	**Structural Complexities**		
	Horizontal	Vertical	Spatial
Bounded rationality	Horizontally roles of purchasing/ sourcing/ procurement professionals are similar. For instance, category managers for different categories perform the same responsibilities such as driving a category to reduce cost or source wisely.	Vertically roles of purchasing professionals can be different. For instance, Chief Technology Officer has a different role than that of a purchasing manager.	Spatially roles purchasing/ sourcing/ procurement professionals can be different because of the difference in purchasing authority in headquarters, in regional hubs and in small site offices.
Contingency theory	Horizontal bounds on purchasing professionals' rationality is created by different contexts. These contexts can be a result of sourcing environment of various categories.	Vertically the contexts can be different when different hierarchical levels of the purchasing organization are positioned at different locations of the world.	Contexts vary significantly with spatial complexity of purchasing organization. For instance, contexts of east Europe are not same as contexts of Asia.

The effects of vertical complexity are mostly visible by changing roles across different hierarchical levels of the organization. For case-I, various roles at the group level were group chief technology officer and group supply chain director. These were the top managers at the corporate headquarters in Stockholm who were responsible for setting the mission and vision for the entire purchasing organization. Because case-I was a decentralized organization, the divisions of the organization that were spread across the world had created another level of hierarchy for the purchasing organization. The key roles of purchasing professionals at these levels were sourcing directors and category managers. There was one sourcing director for each division who was responsible for creating sourcing long term sourcing strategies for the divisions. Category managers on the other hand had the responsibility to create category strategies for their respective categories. The next level of hierarchy was the manufacturing

units managed by each division for which category managers aggregated purchases across the category. The role of purchasing managers in charge of checking quality and delivery of the incoming materials were positioned at the entity level.

Purchasing organization for case-II was centralized compared to decentralized nature of purchasing organization of case-I. As a result, even though the purchasing organization for case-II was complex because of three vertical levels, those were different than that of case-I. At the group level, the top management roles (e.g. VP network sourcing, head of network sourcing) were again to set the strategies for the purchasing organization. At the category level, a number of roles such as category leads, global category heads, category managers, supplier relationship managers were created. While category leads were responsible for one or more similar categories (e.g. category of consultancy and temporary works), global category heads were responsible for categories that were spread across the world. Category managers were responsible for one particular category which had much spend (e.g. category of logistics). At the regional level, the supply manager only created purchase request and ensured that they had received the materials according to the requirements.

It is evident from both case I and case II that the vertical complexity has created different roles for purchasing professional at different hierarchical levels for both de-centralized and centralized purchasing organizations. Because of the large nature of multinationals, these roles in purchasing organizations are performed in different time zones with distinct authorities at different levels. According to the underpinnings of the bounded rationality paradigm (Simon 1955), these roles performed at different will create different information bounds on the purchasing professionals. As a result, their rationality for making purchasing decisions will be bounded by the roles these professionals are performing in the organization i.e. the top management such as chief technology officer or vice president sourcing and will have a different rationality bound than that of a middle manager such as sourcing director or category leads responsible for a division or a particular category. Sarker et al. (2016) have demonstrated that such rationality bounds create visibility issues of internal supplier risk among purchasing professionals. Thus, first proposition that can be put forward is:

Proposition 1: vertical complexity of MNCs creates rationality bounds among purchasing professionals due to division of authorities at different hierarchical level in the purchasing organization.

In comparison, horizontal complexity does not result in role changes in purchasing organizations but a change in context. Difference in context can be due to change of technology such as in case-I, different divisions at the same horizontal level produced different types of product. For instance, in case-I, division A, B, and C produced mechanical and electrotechnical products in different ratios. In contrast, division D had a different technical product i.e. electronic id. Division E had another kind of product i.e. entrance solutions. Therefore, even the roles of sourcing directors and category managers were similar at different divisions, they were exposed to different sourcing environment because of the nature of the product at a particular division. Within one single division, horizontal complexity can vary due to difference in sourcing environment of various categories. In case-II, such differentiation is evident in different categories such as logistics, temporary works, patent.

According to the foundations of contingency theory (Fiedler, 1967) such exposures to different contexts will require the purchasing organization to fit its structure to the particular context it is exposed to. As a result, the rationality of purchasing individuals at different contexts will be different. Therefore, the effect of horizontal complexity on purchasing organization can be described by the following proposition:

Proposition 2: horizontal complexity of MNCs creates rationality bounds among purchasing professionals by exposing them to different contexts.

The effect of spatial complexity on purchasing organization is same as that of horizontal complexity i.e. it too exposes purchasing professionals working at different hierarchical level of purchasing organization to different contexts. The difference is now the contextual variations are due to the practices at a particular country or regions. For instance, division A, B and C in case-I though had similar products but they were at different context of America, Europe and Asia Pacific. Even though the categories were similar among these divisions, the purchasing professionals needed to act different to cater to the need of a particular region. For case-II, the category patent had to pertain to the rules and regulations of a particular country. Where patent rules and regulations were strict, the protection of intellectual properties were easy compare to the regions where rule were not that strict. In such cases, for the same category of patent, the context of a northern European county (e.g. sweden) will not be same as a context of a firm in South America (e.g. Brazil). Therefore, the effect of spatial complexity on purchasing organization can be illustrated by the following proposition:

Proposition 3: Spatial complexity of MNCs creates rationality bounds among purchasing professionals by exposing them to different spatial contexts.

The common effects of all three complexities on purchasing organization are emergence of vertical, horizontal or spatial silos. These silos are created either by different roles of purchasing professionals at different hierarchical levels or exposure of purchasing professional to different contexts. The consequences of such siloed purchasing organization due to internal structural complexity can be two folds. First, the internal visibility of purchasing professionals will be according to their roles or the type of contexts they are exposed to (Sarker et al., 2016). Second, the structural complexity would raise similar integration issues (Lawrence & Lorsch, 1967) in purchasing organization as discussed by the organization theorists for having disintegrated business units around the globe. It means purchasing units working in differentiated silos (either by context or by roles) will require mechanisms for integration in order to perform better. Thus, a final proposition can be added as follows:

Proposition 4: Internal structural complexity of MNCs facilitates emergence of purchasing silos which in turn require integration mechanisms.

In sum, due to internal structural complexity, purchasing organization are divided into roles and responsibilities as well as exposed to different contexts. The conventional form of centralized purchasing organization will fit where integration is needed between differentiated purchasing units. Decentralized form will work best if certain contexts are very unique and centralization is impossible to achieve due to intricacies of the contexts. Because a mixture of centralized and decentralized purchasing strategies have to be practiced in any multinational corporation because of their inherent internal complexity, the purchasing organizations in MNCs will always be hybrid.

Conclusion

MNCs are intricate organizations. The effects of these intricacies also translate into the purchasing organization of MNCs. As a result, a multitude of roles and contexts are created within the organization. This siloed purchasing organization is problematic for a number of reasons. First, it will create various bounds of rationalities among the purchasing professionals (Sarker et al., 2016). It means communications between silos may become an issue. Second,

these differentiated purchasing units will require a mechanism for integration which will be very difficult to attain (Lawrence & Lorsch, 1967). Third, centralization of purchasing function will also difficult to achieve for many categories of these global giants (Sarker et al., 2017). understanding each other will be difficult. Therefore, understanding these effects are not only elemental for academician researching on purchasing organizations but also critical for practitioners working in these MNCs.

The key contribution of the paper is the four propositions that explain the effects of internal structural complexity of MNCs on their purchasing organizations. The effects give the reasons why purchasing organization of MNCs may require to take either a centralize form or a decentralize form, or a combination of both forms. The other contribution of the paper includes use of bounded rationality as an independent lens to explain the effects of internal structural complexity. This is because, bounded rationality has rarely been used as an independent theoretical lens in purchasing and supply chain management literature. The propositions developed in the paper can be tested in other industries in order to address the generalizability issue. Therefore, future research can be directed to understand the effects of internal structural complexity in a wider spectrum of industries.

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Supplier Relationships Management in Digital Service Supply Chain

Minna Saunila[1], Juhani Ukko[1], Sariseelia Sore[2], Tero Rantala[1], Mina Nasiri[1]

[1] Lappeenranta University of Technology, Saimaankatu 11, 15140 Lahti, Finland
minna.saunila@lut.fi; juhani.ukko@lut.fi; tero.rantala@lut.fi; mina.nasiri@lut.fi

[2] Lahti University of Applied Sciences, Niemenkatu 73, 15140 Lahti, Finland
Sariseelia.Sore@lamk.fi

Abstract
This study investigates which supply chain characteristics contribute to supplier relationship value and if such contributions are moderated by the intensity of the supplier-customer relationship. The results of a survey of 109 respondents, gathered from Finnish e-commerce companies, suggest that one of the dimensions of supply chain characteristics (i.e. service delivery characteristics) positively contributes to the supplier relationship value, whereas the other two dimensions (i.e. product characteristics and customer operations) do not. Further, as the intensity of the supplier-customer relationship increases, the substantiality of the connections between product characteristics and supplier relationship value and between customer operations and supplier relationship value increases.

Keywords: Relationship value, Supply chain, Service

Introduction

Supply chain management is under significant pressure to increase its contribution in changing business environments (Weele and Raaij, 2014; Bals et al., 2017). The traditional focus of the purchasing and supply domain has strongly been on cost savings, quality and technology development, and the research in the field has largely been concerned with determining how to run supply chain operations efficiently (i.e. doing things right) rather than effectively (i.e. doing the right things) (Weele and Raaij, 2014). The most recent studies, however, have also shed light on how to mobilize and manage capabilities, fairness and commitment in supply chain relationships (Weele and Raaij, 2014; Jokela and Söderman, 2017).

Among the biggest categorical changes that create pressure on supply chain and purchasing management in the 21st century are service integration and digitalization. In their study, Immonen et al. (2016) explain that the theory of service integration is based on creating value in industrial services and customer-supplier relationships in supply chains. Brito and Nogueira (2009) in turn argue that it is no longer a novelty that digitalization and Information Technology (IT) is changing the ways companies perform and that the importance of understanding the results of IT implementation is demonstrated by a number of studies dedicated to the subject of supply chain management. An example of a digital service supply chain is the acquisition of a web shop, where the purchasing process of the shop, the shop itself and delivering the service to the end customer mainly take place in digital form. Rao et al. (2011) and Griffis et al. (2012) showed that as the use of the Internet as a channel for distributing and selling solutions and goods from businesses to consumers (as well as businesses to businesses) has expanded, so has interest among different scholars, such as those in supply chain management, logistics, and operations. Rao et al. (2011) and Tsai et al. (2013) further argued that the e-retail industry has

grown rapidly during the last five years and the growth trend would continue in the future. Griffis et al. (2012) stated two reasons for the rapid growth: People's access to the Internet has increased substantially during the last decade, and the percent of Internet users who make purchases online has grown considerably.

In digitalized business environments, it is crucial to consider how relationships with suppliers are developed and maintained. This is also known as supplier relationship management, which is a critical business process for developing closer relationships with key suppliers in order to create value (Autry and Golicic, 2010; Bals et al., 2017; Bals and Turkulainen, 2017). It also demonstrates the importance of supply chain characteristics as part of the co-operation activities. For example, sharing of information can promote the integration with suppliers (So and Sun, 2010). However, while better management of supplier relationships increases company performance (Lambert and Schwieterman, 2012), few studies aim to understand the role of key supply chain characteristics in influencing supplier relationship value in digital service supply chains. In addition, the moderating influence of supplier-customer relationship intensity requires further investigation. In this paper, we aim to contribute to this research gap by studying the links between supply chain characteristics, supplier-customer relationship intensity and supplier relationship value.

The paper starts by summarizing the existing literature on supplier relationship management and then describes how the hypotheses of the current study were developed. Section 4 describes the study's methodology, and Section 5 presents the main results of the survey. In Section 6, the main results of the study are discussed and summarized. The final section discusses the study's conclusions, implications and limitations. As digitalization is rapidly expanding in different phases of supply chains and purchasing operations, we believe that the findings of the study can be relevant for many different operators dealing under domain, including digital service suppliers and customers. The implications of the study may also be relevant to digital service and solution providers. In addition to having implications for practitioners, the study's results also have implications for academic scholars.

Supplier relationships management in a digital context

Companies are increasingly interested and dependent on their suppliers' inputs and contributions, and the importance of supply chain management of these inputs and contributions has been increasingly emphasized (Weele and Van Raaij, 2014; Bals et al. (2017). Researchers have begun to reexamine the purposes, processes and functions of supply chains and how to characterize them in global business environments (Lusch, 2011). Thus, supply chain management has received a key strategic role in many contemporary businesses and among different researchers (Lusch, 2011; Bals and Turkulainen, 2017). In today's turbulent and digitizing business environments, supply chain management is under growing pressure to discover additional value generation beyond efficiency seeking behavior and to search for effectiveness by, for example, bringing in supplier product or process innovations and participating in product innovation activities (cf. Turkulainen and Swink, 2016; Bals and Turkulainen, 2017; Bals et al., 2017). As a part of the supply chain management, supplier relationship management is the business process that provides the structure for how these relationships with suppliers can be developed and maintained (Lambert and Schwiterman 2012). Due to changes in the business environments of companies, supplier relationship management has become a critical process for considering risk and achieving sustainability and cost efficiency. Recent studies have also shown that the integration of operations and sharing

of information with suppliers can improve companies' performance (Flynn et al., 2010; Lambert and Schwiterman, 2012) and increase the co-creation of value.

Two of the biggest changes that supplier relationship management has faced and must operate with in the near future are related to digitalization and the increase of services (cf. Lusch, 2011) in purchasing and supply chains. The increase of digitalization and technologies can be considered meta-forces that will change the society and practice of purchasing and supply chain management. Lusch (2011) also explains that among other benefits, as IT increases in companies, the ability to self-service and ability to serve others rises. In response to the increase in IT and digitalization of business environments, several studies have been conducted on the relationships between client and digital service suppliers, which include client-consultant relationships (cf. Dawes et al., 2007), IT outsourcing relationships (cf. Gonzalez et al., 2006; Goo et al., 2007) and relationships between customers and digital service suppliers (Kishore et al., 2003) (Brito and Nogueira, 2009). Although previous studies on digital service supplier relationships seem to have focused on outsourcing, which, according to Bals and Turkulainen (2017), is currently one of the fundamental managerial approaches to seek efficiency and effectiveness in different functional areas, these presented studies emphasize the importance of relationship management with suppliers to gain advantages from the adoption of digitalization. Brito and Nogueira's (2009) study provides further evidence that in the relationships between customers and digital service suppliers, IT resources from both parties are exchanged and combined, thus enhancing their related capabilities. Although the studies emphasize the importance of relationship management, the appropriate level of supplier integration will depend on the relationship, and an effort should be made to identify strategies for different types of relationships (cf. Das et al., 2006; Lambert and Schwiterman, 2012).

Hypothesis development

Supply chain characteristics as antecedents of relationship value

In today's information age, digital business has become one of the most important ways of selling, buying and offering both products and services for companies (c.f., Zeithaml. et al., 2002; Gotzamani and Tzavlopoulos, 2009; Oliveira and Roth, 2012). However, only a few of these companies can earn substantial profit or create more value from these digital product-service-combination businesses. In order to be successful in digital business, there is a need to identify which characteristics made successful digital business companies different from other e-shops (Gotzamani and Tzavlopoulos, 2009).

Researchers have developed various quality models that identify what is important for value creation in e-commerce. Schubert and Dettling (2002) classified the elements of e-commerce according to three dimensions, including ease of use, usefulness and trust; the authors also discussed the use of the extend web assessment method as a tool. In the context of e-commerce, Su and his collogues (2008) classified quality factors into six different dimensions, including outcome quality, consumer service, process controllability, ease of use, information quality and website design. Parasuraman et al. (2005) consider that the product characteristics that contribute to the perceived quality of the service include efficiency, fulfillment, system availability and privacy. Similarly, Huang et al. (2015) refer to the product characteristics relating to mobile service quality as efficiency, functionalities of the content and system availability. According to Gotzamani and Tzavlopoulos (2009), e-commerce quality constitutes a variety of factors that are co-related and interact with each other. Product characteristics include factors such as attractiveness, serviceability and product/service differentiation and

customization, reputation and assurance. Currently, e-commerce companies constantly seek new ways to enhance the customer experience by updating their virtual stores with new features and capabilities, such as mobile commerce, dynamic imaging, social networking, and customization (Tsai et al., 2013). As variety of product characteristics have been found to provide value to the customer, and these characteristics are likely to enhance the perceived supplier value. Therefore, it is hypothesized that product characteristics have a direct impact on supplier relationship value. Consequently, the following hypothesis was developed regarding e-commerce in the B2B context:

H1: Product characteristics have a positive effect on supplier relationship value.

The vast number of studies have mentioned the huge role of customers during the process of service delivery in creating value (Zeithaml. et al., 2002; Gotzamani and Tzavlopoulos, 2009; Oliveira and Roth, 2012). In B2B companies, customers enable value creation by providing accurate and updated information during the service delivery process for other suppliers (Fliess and Kleinaltenkamp, 2004). According to Ovalle and Marques (2003), supply chain managers experience issues such as misinformation and mistrust in case of time delays, distorted demand signals and lack of knowledge about the status of the products or services. Consequently, sharing accurate information at right time and in the right context are important characteristics for improving companies' supply chain performance (Ovalle and Marques, 2003). In addition, several studies have considered the integration of information systems as a must for companies (e.g., Ellram, 1991; Gunasekaran and Ngai, 2004). On the other hand, according to Zhang and Chen (2008), there is a positive relationship between supplier relationship and customization (Zhang and Chen, 2008).

An increase in the number of relationships between suppliers and other parties in business enhanced the importance of fairness, trust, equity and commitment, as well as the application of these characteristics in the context of business relationships (Emberson and Storey, 2006; Gotzamani and Tzavlopoulos, 2009; Oliveira and Roth, 2012). Based on previous research, fairness refers to the fair treatment of business partners, and this fair treatment encompasses a wide range of activities, such as sharing financial benefits (Cox, 2001), decision making (Duffy et al., 2013; Griffith et al., 2006) and cultivating fair relationships among companies (Luo, 2009; Jokela and Söderman, 2017); these activities generate customer value (Liu et al., 2012; Luo, 2009). The existence of fairness is a vital characteristic for continuing business relationships (Luo, 2006; 2009), while the lack of fairness in a relationship results in the dissolution of the relationship (Duffy et al., 2013).

In the context of e-commerce, different models have been proposed, and some relevant characteristics for value creation have been measured. Therefore, characteristics such as richness of information sharing, integrated cooperation and processes and trust among the companies are important for e-commerce, while delay in information sharing, out-of-date information about products and service and poor data translates are among the activities that lead to huge costs, missed revenue and dissatisfaction (Ovalle and Marques, 2003). Parasuraman and his collogues (1985) have proposed the SERVQUAL model and measured reliability, responsiveness, assurance, empathy and tangibles as the factors of service quality. Additionally, satisfying delivery promised in terms of time and quality, contact customer service, tracking of the status of the orders from the time of ordering until delivery, and high-quality websites are among the crucial operations components that can make or break satisfaction for customers (Boyer et al., 2002). A variety of service delivery characteristics were

found to provide value to the customer. These characteristics are likely to enhance the perceived supplier value. Therefore, in the B2B context, we hypothesize the following:

H2: Service delivery characteristics have a positive effect on supplier relationship value.

In digital businesses, it is necessary to satisfy the needs of e-shoppers (c.f., Zeithaml. et al., 2002; Gotzamani and Tzavlopoulos, 2009). In addition to this, digital companies rely heavily on the number of people who visit their website, purchase their products or services and become permanent customers (Smith and Merchant, 2001). As quality is one element that contributes to business growth, several studies have considered the quality of websites and customer services as the elements that boost profitability in business (cf., Gotzamani and Tzavlopoulos, 2009).

E-commerce makes it possible to shorten the time it takes to get products/services to the market; allows for growth in market share, sale, service processes and customer operation; and allows for a fast response to customer preferences. These features lead to value creation and better supply chain performance. Different quality models have been defined for value creation in the context of e-commerce. Proposed by Loiacono (2002), the TM model refers to the quality of the website and identified information fit-to-task, interactivity, trust, visual appeal, innovativeness, flow/emotional appeal, design appeal, intuitiveness, response time, integrated communication, business process and viable substitute as the 12 factors that must be considered in e-commerce (Loiacono, 2002). Barnes and Vidgen (2003) explain that consumers expect e-shops to be usable and informative and that consumers expect their relationship with the website to be good. Gotzamani and Tzavlopoulos (2009) refer to the website characteristics that have replaced the value provided by a physical store, such as system quality and information quality, as well as the aesthetics, structure and features of the website. Delone and McLean (1992) concentrated on the quality of information systems. They considered system quality, information quality, use, user satisfaction, individual impact and organizational impact as the main dimensions for the quality of the e-commerce. Based on the studies conducted by Lee and Lin (2005), website design, reliability, responsiveness, trust and personalization are among the elements in the e-service process. Based on Yoo and Donthu's (2001) studies, different characteristics, including esthetic competitive value, ease of use, design, ease of ordering, corporate and brand equity, processing speed, security, product uniqueness and product quality assurance have been mentioned in the SITEQUAL model as elements that are related to the experience of online purchasing. Additionally, different studies have mentioned information quality, user interface quality and security as three important items for customers during their online purchasing (Park and Kim, 2003; Oliveira and Roth, 2012). According to Yoon et al. (2008), e-commerce companies continuously face the challenge of enhancing customer trust and building relationships with customers. Due to this, they must understand what determines customer operations in the e-commerce environment. A variety of customer operations related to digital services have been considered to provide value to the end user. These operations are likely to enhance the value that the supplier has produced when supplying the digital service. Based on previous research, the following hypothesis was formed:

H3: Customer operations have a positive effect on supplier relationship value.

Supplier-customer relationship intensity as a moderator

One way to understand the changes in the development of customer value propositions is the recognition that it becomes easier for companies to look further down their supply chains to see

changes emerging multiple links away, thus providing additional lead time for operational and strategic planning and adjustments (Cheung et al., 2010). According to Cheung et al. (2010), this can also be considered as viewing the "supplier as a customer." Prior research in the operations and supply chain management have presented a variety of factors for *supplier-customer cooperation*, whose existence can be associated with relationship performances (e.g. Cheung et al., 2010; Li et al., 2010; Liu et al., 2009; Prahinksi and Benton, 2004). From the supplier-customer relationship point of view, Tsai et al. (2013) presented in a study of e-retailers' technology sourcing strategies that a well-designed IT infrastructure is an essential part of generating a tightly integrated value chain and delivering high-quality service. Cocreation between e-retailers and suppliers represents a critical component of service delivery processes through which e-retailers have direct input in the development of e-services (Ngo and O'Cass, 2009). The exchange of information, joint sense making and knowledge integration have been documented as important factors for the supplier-customer relationship, especially from a learning perspective (Cheung et al., 2010). These factors are also connected to the *responsiveness towards the supplier* in terms of the effectiveness with which problems are handled, the willingness to help the supplier and the speed with which a response to a problem or question is made (Huang et al., 2015; Parasuraman et al., 2005; Gotzamani and Tzavlopoulos, 2009). Prior literature often presents the length of cooperation as a proxy for the closeness of social relations between partners (Dyer and Chu, 2000; Li et al., 2010). Dyer and Chu (2000) suggest that long-term interactions between partners would be helpful to gain an in-depth understanding of each other. Lengthy cooperation also enables partners to share private information, decrease information asymmetries and facilitate the *development of trust* (Poppo et al., 2008). Trust can be defined as one party's confidence that the other party in the exchange relationship will not exploit its vulnerabilities (e.g., Li et al., 2010). Trust can also be defined as the confidence or belief that the exchange partner possesses about the honesty and benevolence of other partners (Kumar et al., 1995). The corporate image and reputation of supplier are also associated with the development of trust (Huang et al., 2015; Parasuraman et al., 2005). It is documented that when trust and behavioral norms are developed, partners are more effective in improving communication, information flow, knowledge sharing and solidarity (Hult et al., 2004), and if the company seeks to improve relationship performance only, inter-company trust and relational norms become an even more important means for this end (Liu et al., 2009). Based on the current understanding, we believe that the intensity of the supplier-customer relationship enhances the connection between product characteristics and supplier relationship value, service delivery characteristics and supplier relationship value and customer operations and supplier relationship value. In line with this, the following hypotheses were developed:

H4: Relationship intensity moderates the connection between supply chain characteristics and supplier relationship value.

H4a Relationship intensity moderates the connection between product characteristics and supplier relationship value.

H4b Relationship intensity moderates the connection between service delivery characteristics and supplier relationship value.

H4c Relationship intensity moderates the connection between customer operations and supplier relationship value.

Research model

The theoretical review discussed in previous sections led to the development of the research model, which is presented in Figure 1. The research model indicates that supply chain

characteristics, as a three-dimensional construct with the dimensions of product characteristics, service delivery characteristics and customer operations, are relevant for improving supplier relationship value. Further, it is argued that supply chain characteristics and supplier-customer relationship intensity interact with each other to maximize supplier relationship value.

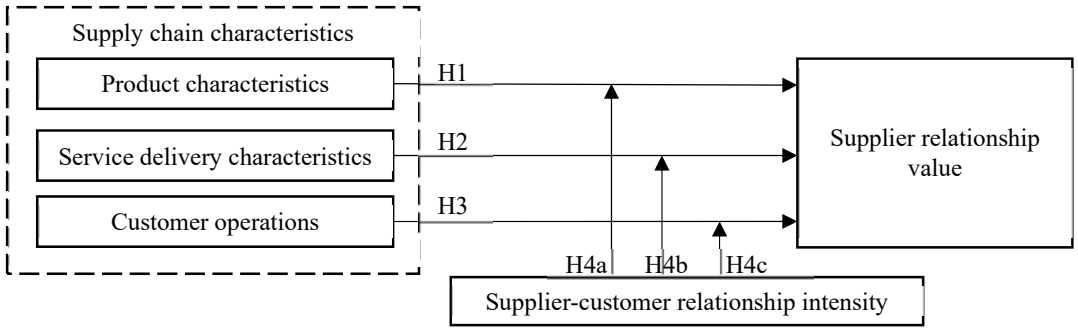

Figure 1. Research model and hypotheses.

Methodology

Construct operationalization

A survey-based approach was utilized to test the hypotheses. A literature review helped to identify relevant constructs and previously operationalized scale items. Measurement items related to supply chain characteristics and supplier-customer relationship intensity were adapted from the literature, but they were modified in order ensure contextual consistency. The measure of supplier relationship value was developed specifically for this study. To ensure validity, the measure was developed based on existing research. All of the scales were refined in collaboration with experienced researchers, and the scales underwent formal pretests to assure content validity. Table 1 presents the measurement items.

Table 1. Measurement scales

Items	No	References	
Supply chain characteristics			
Product characteristics		Zeithaml. et al., 2002;	**α = 0.850**
('Strongly disagree' [1] to 'strongly agree' [5])		Gotzamani and	
Usability/efficiency	3	Tzavlopoulos, 2009;	
Functionalities	4	Oliveira and Roth, 2012;	
Security	2	Huang et al., 2015	
Continuous operation/System availability	6		
Service delivery characteristics		Zeithaml. et al., 2002;	**α = 0.916**
('Strongly disagree' [1] to 'strongly agree' [5])		Gotzamani and	
Information/contact	4	Tzavlopoulos, 2009;	
Responsiveness	2	Oliveira and Roth, 2012;	
Fulfillment	2	Huang et al., 2015	
E-customization	2		
Sacrifice	2		
Customer operations		Zeithaml. et al., 2002;	**α = 0.850**
('Strongly disagree' [1] to 'strongly agree' [5])		Parasuraman et al., 2005;	
Information/contact	4	Oliveira and Roth, 2012	
Responsiveness	2		
Fulfillment/flexibility	4		
Security	2		
E-customization	2		
Supplier-customer relationship intensity			**α = 0.812**

('Strongly disagree' [1] to 'strongly agree' [5])		Parasuraman et al., 2005;
Cooperation	2	Gotzamani and
Trust development	2	Tzavlopoulos, 2009;
Responsiveness towards the supplier	2	Oliveira and Roth, 2012
Supplier relationship value		
('Weak [1] to 'excellent' [4])		
Value gained from the relationship	1	

The independent variables of the survey were the supply chain characteristics. The supply chain characteristics were operationalized as a three-dimensional construct, with the dimensions of product characteristics, service delivery characteristics and customer operations. Product characteristics reflect the characteristics of the digital product-service-combination that the supplier produced for the B2B customer company. Service delivery characteristics reflect the characteristics of the service that the supplier has offered during the digital product-service-combination delivery process. Finally, customer operations reflect the routines of the B2B customer company related to the supplied digital product-service-combination. The moderator variable was the supplier-customer relationship intensity. The six items of this variable estimate the depth of the relationship between the supplier and the customer of a digital product-service-combination. The dependent variable was the supplier relationship value. It was measured with a single-item measure. Single item measures can be used when the research setting includes singular concrete objects and attributes (Bergkvist and Rossiter, 2007) that are homogenous (Loo, 2002) and unambiguous to the respondent (Sackett and Larson, 1990). This is the case in this study. The survey also included controls for contextual variables that may have potentially confound the results. Controls included company size (measured by the number of employees), sales (measured by the portion of sales through digital channel) and the age of digital service (measured by the number of years the shop had been in existence).

Sample and data gathering

The survey was conducted in Finnish e-commerce companies. The companies had supplied a web shop and they were asked to evaluate the purchasing process of the shop as an example of a digital service supply chain. Respondents were responsible for business and customer service tasks related to e-commerce and digital business. The respondents were also managerial-level employees, as managers were expected to have adequate knowledge to answer the items concerning their company's supply chain operations. Thus, the respondents had good capability to respond to a survey that mapped the current state of their companies' digital service supply chain. The unit of analysis in the study is the individual respondent's perceptions of the supply chain characteristics and supplier-customer relationship intensity as well as the value of their company's supplier-customer relationship. Thus, the respondents provided their personal evaluations of the constructs in their company.

Initially, 2541 respondents were invited to participate in the study. 229 contacts were invalid, and the survey reached 2312 respondents. After eliminating incomplete surveys, our final sample consisted of 109 (response rate about 4.7%) responses from 107 B2B customer companies. The response rate is not always the best measure for assessing the accuracy of the results, as it ignores the compounding effect of sampling and coverage errors. The target population of this study was e-commerce companies operating in Finland that had a web shop in operation. The directive number of such companies was 7500. Besides the response rate, the accuracy of survey results should be assessed by the representativeness of the respondents. The initial sample was randomly selected among these companies and contained about 30% of the total amount of Finnish companies that had a web shop. Overall, the sample was representative

of a large amount of the entire target population. Further, the number of responses exceed the minimum returned sample size for given population size (Barlett et al., 2001). Sample size is considered appropriate.

Non-response bias

To determine whether there was non-response bias, an analysis of the variance test was performed. Early respondents were compared to later respondents on the key variables: product characteristics, service delivery characteristics, customer operations, supplier-customer relationship intensity, and supplier relationship value. Early respondents were those individuals who completed the questionnaire within the deadline after receiving the first e-mail. Respondents who responded to the subsequent e-mails were classified as late respondents. Those who were among the last to respond most closely resembled non-respondents (Armstrong and Overton, 1977). If there are no differences between early respondents and late respondents, it is likely that there are no differences between respondents and non-respondents. The results indicated no significant differences between the early and late respondents regarding key variables. Therefore, it was confirmed that non-response bias did not cause problems, and the responses were well representative of the entire sample.

Results

Measurement model

Before testing the hypotheses, the level of reliability and validity was assessed. As Table 1 shows, Cronbach´s α values are greater than 0.8, indicating that the measurements are reliable. High Cronbach´s α values also support internal consistency, which was further investigated by performing factor analysis using principal components with no rotation separately for each construct. All the items of one variable loaded to one factor, which supports internal consistency. Next, correlation analyses (Table 2) were conducted in order to investigate if the constructs behave in a credible manner. In some cases, the correlations were high, which may mean that multicollinearity can cause problems. For multicollinearity, the variance inflation factors (VIF) were calculated for each predictor by conducting a linear regression of that predictor on all the other predictors. All the VIFs were considerably lower (less than 2.0) than the recommended threshold of 5–10, suggesting that multicollinearity was not a problem (Kleinbaum and Kupper, 1988). The normal distribution of each variable was assessed via a measure of skewness. Each variable appeared to have an approximately normal distribution.

Table 2. Descriptive statistics and correlations of the variables.

	Mean	**St.Dev.**	**1**	**2**	**3**	**4**
1 Product characteristics	3.88	0.569	1.000			
2 Service delivery characteristics	3.45	0.775	0.503***	1.000		
3 Customer operations	3.86	0.567	0.532***	0.379***	1.000	
4 Supplier-customer relationship intensity	3.58	0.718	0.486***	0.669***	0.337**	1.000
5 Supplier relationship value	2.93	0.799	0.400***	0.707***	0.234*	0.568***

Sign. *** ≤ 0.001, ** 0.001 < p ≤ 0.01, * 0.01 < p ≤ 0.05

The possibility of common method bias was checked, as a single respondent from a company was used. During the data gathering process, multiple procedural remedies were used to minimize the potential of such bias (see Podsakoff et al., 2003). The respondents were encouraged to answer the items as truthfully as possible and were allowed to answer anonymously. These actions decreased the respondents' likelihood of editing their responses to

be more socially desirable. Common method biases were also reduced by paying attention to the construction of the items. Also, methodological separation was used to reduce the risk of common method bias (Craighead et al., 2011). Thus, different variations of Likert-type scales were employed, such as "weak/excellent" and "strongly disagree/strongly agree." In addition, Harman's single-factor test (Podsakoff et al., 2003) was performed. All the variables were loaded into an exploratory factor analysis, and the unrotated factor solution was analyzed. In this case, the main factor explained only 30.3% of the total variance, and no significant common method variance existed (Podsakoff et al., 2003).

Hypothesis testing

A main effects model was used to test hypotheses 1–3. Table 3 shows that the direct effects of product characteristics on supplier relationship value ($\beta = 0.156$; $p = 0.189$), customer operations on supplier relationship value ($\beta = -0.145$; $p = 0.155$) and supplier-customer relationship intensity on supplier relationship value ($\beta = 0.045$; $p = 0.708$) were not significant. However, the direct effect of service delivery characteristics on supplier relationship value ($\beta = 0.697$; $p = 0.000$) was significant. Thus, the results provided support for Hypothesis 2.

The full model, which is presented in Table 3, was used to test hypotheses 4a–4c. The full model included the interaction terms, and comparison with the previous model allowed for estimating the effect caused by the interaction term. The results suggest that supplier-customer relationship intensity has a significant interaction effect on the path from customer operations to supplier relationship value ($\beta = 1.261$; $p = 0.097$). Hence, we can interpret from these observations that the influence of customer operations on supplier relationship value increases with an increase in the depth of the supplier-customer relationship. However, the interaction effect of supplier-customer relationship intensity on the path from product characteristics to supplier relationship value was significant, but the impact of product characteristics on supplier relationship value decreased when the depth of the supplier-customer relationship was greater ($\beta = -1.994$; $p = 0.047$). The interaction effect of supplier-customer relationship intensity on the path from service delivery characteristics on supplier relationship value was not significant ($\beta = 0.696$; $p = 0.346$).

Discussion

This study examined the direct impacts of supply chain characteristics, namely product characteristics, service delivery characteristics and customer operations, on supplier relationship value, and examined the moderation effects of supplier-customer relationship intensity on that connection. Thus, our research contributes to prior research on the impact of supply chain characteristics on supplier relationship value (e.g. Ovalle and Marques, 2003; Brito and Nogueira, 2009; Autry and Golicic, 2010; Jokela and Söderman, 2017). Considering the direct effects of the main effect model (Table 3), the relationship between service delivery characteristics and supplier relationship value was highly significant, while no other direct and significant effects could be found. Regarding the value creation in the supplier-customer relationship in a B2B environment, it seems that the influence of the characteristics of service delivery outcome overrides that of the product characteristics and the customers' own operations. This highlights that different characteristics of service delivery, such as sharing accurate, updated and timely information during the service delivery process (Fliess and Kleinaltenkamp, 2004; Ovalle and Marques, 2003), together with different characteristics of quality elements, such as reliability, responsiveness, assurance, empathy and tangibles (Parasuraman et al., 1985; 2005), can be considered value drivers for the supplier-customer

relationship. However, there may be a need to integrate these service delivery characteristics as a comprehensive solution to facilitate the relational perspective for value creation, as suggested by Immonen et al. (2016). Additionally, the integration and quality of the information system (e.g. Delone and McLean, 1992; Ellram, 1991) as well as decision making process (Duffy et al., 2013; Griffith et al., 2006) have been considered value drivers for service delivery in the supplier-customer relationship and can thus be reviewed in future research. Where Lambert and Schwiterman (2012) present supplier relationship management as a business process that provides the structure for how these relationships with suppliers can be developed and maintained, the current study suggests that these procedures can be targeted to the service delivery characteristics in value creation in the supplier-customer relationship.

Another contribution relates to the prior research on supplier-customer relationship intensity (e.g. Liu et al., 2009; Cheung et al., 2010; Li et al., 2010). Considering the interaction effects in the full model (Table 3), the results indicates that the supplier-customer relationship positively moderates the relationship between customer operations and supplier relationship value. This means that the high intensity in the supplier-customer relationship, for example, in terms of supplier-customer cooperation and the development of trust is connected to customer operations with the delivered service in a way that affect the value of the supplier relationship. This may indicate that considering the "supplier as a customer" together with the relationship learning in terms of exchange of information, joint sense making and knowledge integration (Cheung et al., 2010) is associated with customers' operations with the delivered digital service (Barnes and Vidgen, 2003; Park and Kim, 2003; Yoo and Donthu, 2001), and generates a higher supplier relationship value. The cooperation that is based on the relationship learning provides better knowledge and skills for the customers to address the issues described above. The study thus strongly supports the importance of relationship learning in creating relationship value, as presented by Cheung et al. (2010). The responsiveness towards the supplier in terms of the effectiveness with which problems are handled, willingness to help the supplier and quick response to a problem (Huang et al., 2015; Parasuraman et al., 2005) is also connected to the relationship learning and considering the "supplier as a customer", thus improving the knowledge and skills that customers need in their operations. Furthermore, relationship learning, together with the willingness to have a long-term relationship are characteristics that facilitate the development of trust and further positively affect the relationship between customer operations and supplier relationship value. The study thus highlights the development of trust as an integral part of the supplier-customer relationship and an essential element in supply chain value creation, as presented by Poppo et al. (2008). The findings also suggest that the supplier-customer relationship negatively moderates the relationship between product characteristics and supplier relationship value. This may indicate that the more intensive the supplier-customer relationship is, the more irrelevant the product characteristics themselves are. In an intensive supplier-customer relationship, the supplier relationship value is created through the customer's own actions with the delivered digital service.

Where some previous studies on digital service supplier relationships focused on outsourcing in order to find efficiency and effectiveness in different functional areas (e.g. Bals and Turkulainen, 2017) or called for the exchange and combination of resources to enhance IT capabilities, the findings of the current study suggest that focusing on the service delivery characteristics that are connected to the customers' operations, especially the intensity of the supplier-customer relationship, generate supplier relationship value in an e-commerce delivery process. This can also be kept in mind when identifying strategies for supplier-customer relationships in digital services, especially in e-commerce adoption (e.g. Das et al., 2006; Lambert and Schwiterman, 2012).

Table 3. Regression results for supplier relationship value

Variables	Control model			Main effects model			Full model		
	β	St. β	t	β	St. β	t	β	St. β	t
Controls									
No. of employees	-0.001	-0.084	-0.736	0.000	-0.039	-0.509	-0.001	-0.053	-0.694
	(0.001)			(0.001)			(0.001)		
Age	0.001	0.000	0.004	0.066	0.040	0.512	0.033	0.020	0.253
	(0.190)			(0.128)			(0.130)		
Portion of sales	0.004	0.144	1.233	0.001	0.043	0.525	0.001	0.041	0.495
	(0.003)			(0.002)			(0.002)		
Main effects									
Product characteristics				0.222	0.156	1.326	1.534	1.081	2.323*
				(0.167)			(0.660)		
Service delivery characteristics				0.741	0.697	6.086***	0.327	0.308	0.736
				(0.122)			(0.445)		
Customer operations				-0.211	-0.145	-1.437	-1.132	-0.778	-2.110*
				(0.147)			(0.536)		
Supplier-customer relationship intensity				0.050	0.045	0.376	0.137	0.122	0.350
				(0.134)			(0.392)		
Interaction effects									
Product characteristics* Supplier-customer relationship intensity							-0.399	-1.994	-2.025*
							(0.197)		
Service delivery characteristics* Supplier-customer relationship intensity							0.121	0.696	0.950
							(0.128)		
Customer operations* Supplier-customer relationship intensity							0.270	1.261	1.684+
							(0.161)		
Model summary									
F			0.809			15.754***			11.694***
R^2			0.031			0.615			0.639
Adjusted R^2			-0.007			0.576			0.585
F Change						14.945			10.885
R^2 Change						0.584			0.608

Sign. *** ≤ 0.001, ** 0.001 < p ≤ 0.01, * 0.01 < p ≤ 0.05, + 0.05 < p ≤ 0.1
(Standard errors in parentheses)

Conclusions

The results contribute to our understanding of the links between supply chain characteristics, supplier-customer relationship intensity and supplier relationship value. Specifically, we examined the impacts of supply chain characteristics on supplier relationship value by identifying the moderating impacts of supplier-customer relationship intensity. The supply chain characteristics were assessed on three dimensions: product characteristics service delivery characteristics and customer operations.

The current study enriches research on supplier relationship management by lending support to the interaction effect of the supplier-customer relationship intensity on supplier relationship value. Our study argues that one dimension of supply chain characteristics, service delivery characteristics, is positively related to the supplier relationship value. Also, supplier-customer relationship intensity enhances the connection between customer operations and supplier relationship value. As a practical implication, the study provides empirically-proven guidance to understand the role of supplier-customer relationships in the connection between supply chain characteristics and supplier relationship value. The findings of our study could provide useful insights for managerial decision making by informing suppliers about which supply chain characteristics are likely to influence supplier relationship value so that suppliers can improve these characteristics.

The study has limitations that provide opportunities for further studies. First, the data is cross-sectional in nature. Longitudinal data would assist in providing an in-depth understanding of how supplier-customer relationships affect value creation. Second, the demographics may limit the generalizability of our findings, as the data was gathered from Finland. Also, a common method bias can cause problems when the key informant approach is utilized. Fourth, supplier relationship value was the only dependent variable and thus the only performance measure. Thus, the theoretical model of this study can be further studied by using other performance measures, such as financial performance and market performance, as dependent variables. Further research could address these limitations and build on the findings of this study.

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Dynamics in Sourcing Teams: Determinants of Best Performance

Tobias Schoenherr
Professor of Purchasing and Supply Management
Department of Supply Chain Management
Eli Broad College of Business
Michigan State University
North Business College Complex
632 Bogue Street, Room N370
East Lansing MI, 48824, USA
Phone: +1-517-432-6437; Fax: +1-517-432-1112
Email: Schoenherr@bus.msu.edu

SUMMARY
Team dynamics can be an influential determinant for team performance. While research in this area has been done in general management, insight is lacking in the domain of sourcing. This research fills this gap by reporting the results of a survey that was designed to offer insights into sourcing team dynamics that enable or hinder the team's success. Dimensions theorized to explain differential performance outcomes include cooperative norms, task and emotional conflict, group cohesion, psychological safety and goal similarity. The hypotheses are tested in two culturally diverse contexts—the U.S. and Japan—expected to yield differential outcomes based on their cultural characteristics.

Keywords: sourcing teams; team performance; group dynamics; survey

Increased global competition, shorter clock-speeds, and greater customer demands have become the order of the day, demanding organizations to change how they do business (Gunasekaran et al., 2008). While companies have made great strides to integrate with external stakeholders, particularly suppliers (Petersen et al., 2005), the internal integration link has often been noted as not being as well developed. However, the internal perspective cannot be neglected, and plays an important part in accomplishing the best results for the organization. Specifically, the needed internal capability pertains to cross-functional sourcing teams (Johnson et al., 2002), integrating different internal perspectives to help the organization propel its differentiation and competitive advantage in this fast-changing environment (Hardt et al., 2007).

While the use of cross-functional teams in sourcing makes sense (Luzzini and Ronchi, 2011), it is easier said than done (Majchrzak et al., 2012). Impediments to greater team performance can include a lack of understanding of each other's perspectives, unwillingness to compromise, misalignment of performance measures, and the reluctance to give up control. Recent research in cross-functional sourcing teams has identified teamwork training and team processes as instrumental in enabling team success (Driedonks et al., 2010). While team processes pertain more to infrastructural aspects that may be addressed by putting appropriate procedures in place, a more challenging dimension may be to train individuals to effectively work in teams (teamwork training). This calls attention to the behavioral aspects that need to be considered in team formation and management.

While general management researchers have been studying behavioral issues for decades (e.g., Deckop et al., 2005; Ng and Van Dyne, 2005), only recently have scholars in

supply chain management devoted attention to organizational behavior. Much of the work has been done in the area of operations management, bringing insight into behavioral issues coming into play in managing a production environment (e.g., Bendoly et al., 2010; Schoenherr et al., 2017). However, an area that has still largely been neglected is organizational behavior in cross-functional sourcing teams (Driedonks et al., 2010). It is the objective of the present research to offer insight into this emerging domain via cross-cultural empirical study.

Relying on group dynamics theory (Lewin, 1947), we develop hypotheses pertaining to the influence of cross-functional team characteristics on team performance. Specifically, we theorize about the influential roles played by the dimensions of cooperative norms of the team, task and emotional conflict, group cohesion, psychological safety and goal similarity. Cooperative norms refer to the degree to which individuals in teams are expected to help each other (Ng and Van Dyne, 2005). Task conflict can be defined as "disagreements among group members about the content of the tasks being performed, including differences in viewpoints, ideas, and opinions" (Jehn, 1995, p. 258), while emotional conflict derives from interpersonal disagreements that are independent of the task (Jehn, 1995). Group cohesion refers to aspects that make teams stay together (Festinger, 1950), which are often related to interpersonal dimensions (Ng and Van Dyne, 2005). Psychological safety assesses how team members perceive the team environment to be safe for expressing their—potentially dissenting—thoughts and opinions (Edmondson, 1999). Goal similarity refers to the degree to which all team members agree on what is important for the team (Jehn, 1995). The dependent variable, team performance, is conceptualized as the extent to which the team accomplished the desired objectives in an effective manner (Linderman et al., 2006). In addition, taking a contingency perspective, we theorize about the moderating role of task characteristics inherent to the project at hand. Task interdependence has been shown to be a significant dimension shaping the context (Sharma and Yetton, 2003), substantiating it as a relevant contributor, especially within our setting considered.

To test the hypotheses, a survey was conducted among U.S. manufacturers. A single-response format was used, asking a key contact about team dynamics and behavior in a recent cross-functional team engagement. While this limits our ability to comprehensively assess the team dynamics (by merely focusing on one respondent describing the team), this made the study more manageable. We note this aspect though as a limitation. Measurement items for the multi-item constructs were based on established scales, which were adapted to our context of sourcing teams. Since the questionnaire was targeted at very specific individuals within organizations, a professional survey research firm was hired to collect the data (Schoenherr et al., 2015). Requirements for participation included the respondent to be within the purchasing function, and for them to having been involved in a sourcing team during the last year. The respondent could be either involved as a team leader or as a team member. A merit of this type of data collection is that responses are collected only from individuals that perfectly match the criteria. A total of 166 valid and complete responses were received for the U.S. sample, and a total of 227 valid and complete responses for the Japanese sample.

We have just started analyzing the data and their psychometric properties, including reliability and validity of the constructs. Once the sound measurement is confirmed, we will proceed with the testing of the hypotheses. This will be done through moderated multi-group regression analysis. Results will be presented at the conference.

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How to select supplier offers under the aspect of innovation

Florian Schupp
Senior Vice President Purchasing Automotive of Schaeffler Group. Jacobs University in Bremen. Address : Im Grün 3, 77886 Lauf, Germany, schupp-florian@t-online.de

Matthias Rehm
General Manager of Max Hauser, PhD University of Antwerp, Address : Duttentalstrasse 24/3, 78532 Tuttlingen, rehmmatthias@web.de

Pr. Richard Calvi
IREGE laboratory, University of Savoie Mont-Blanc
Address : IAE SMB, 1 route de Saint Cassin à Jacob, Bat 23, 73011 Chambéry Cedex - France. richard.calvi@univ-smb.fr

Abstract
For a mature purchasing organization, developing and integrating the technological capabilities of suppliers into the company offer creation process is increasingly a key task. In this matter, one practical question that arises for a CPO is the organization of a systematic and fair consideration of supplier offers during the selection phases of each New Product Development (NPD) process. However, the more the specifications are functional, so as to encourage innovation from suppliers, the more difficult it is to compare offers. In this article we will start by picking up the different pitfalls inherent to this innovation sourcing process and afterwards we will present a method base on a bid comparison model based on the notion of *value in use* of the possible combinations of characteristics of the purchased product. Combined with a *reservation price,* we propose a preference curve and a feasibility curve. This process creates a space of solutions for supplier innovations that can be located below and above a given target price.

Key words: Innovation sourcing, Offers selection, ESI, EPI.

Introduction:

Innovation is driven by ideas. Ideas are generated by individuals or companies. If individuals or companies want to sell their innovations, they need to find a market that wants to buy the innovation. This requires that the product attributes of the innovation are explained to potential customers. In situations where the innovating body exactly meets the technical customer demand, the price will decide if the transaction will happen. In cases where the technical customer demand does not exactly match with the offered product, the specific characteristics of the different product attributes have to be changed to match with possible or acceptable solutions for the customer. When a product has more than one defining attribute, each difference results in differentiable product stimuli. Such stimuli can be ranked by the customer in order to indicate preferences of one product solution over another one. By the method of conjoint analysis (Green and al., 1981) following the weighting of product attributes in importance for the customer, the technical utility value of each attribute characteristics can be calculated. The customer can after indicate his payment willingness in form of a *reservation price* for each product stimulus. The resulting curve

out of this activity is a customer preference curve that contains the two dimensions price and technical utility value.

If one now takes the customer perspective instead of the perspective of the single innovating body, the customer or buying firm can ask several innovating bodies to submit offers in form of utility-price combinations for a functionally specified product. Each innovating body or potential supplier can offer for him feasible utility-price combinations. If one or more innovating bodies would like to offer new or unforeseen product characteristics within given attributes or even new exclusive attributes, the customer has to take a decision to update the attribute catalogue or in other words his preference curve. Following, a negotiation over price and technical utility can take place. To prevent from the temptation to use technical innovation from one supplier by updating the customer specification and to renegotiate only over price with the risk that the true innovating body will lose his innovative idea to a competitor, the negotiation in such case should run in parallel over technical utility and price.

This short description introduces the scenery of our purpose. Our research question *is How a purchasing function can introduce a systematic method in order to compare and select supplier offers including some innovating characteristics in order to maximize both the overall utility for the final user and the benefits for the buying company?*

The following article will explain first why product innovation by suppliers should be element of the scope of purchasing. After describing the main pitfalls connected to the management of innovation coming from suppliers, a purchasing model is developed that allows fast measurement and valuation of technical and functional supplier ideas. With this model, the technology dimension can be integrated to the supplier sourcing decision in addition to the price which helps ensures and even to enhance competition

Why supplier innovation should be in the scope of purchasing?

Several researchers discuss the assimilation of external knowledge as a necessity to minimum accelerate or to reinforce internal innovation (Chesborough 2003). Regarding the innovation target itself, it was shown by Simon (2007) that if a company wants to reach market leadership, innovation and technological advantage are the key success factors. A similar finding was concluded in a study of the Fraunhofer Institute for Systems and Innovation Research about the structure and drivers of innovation success in the German machine building industry. The two elements innovation and technology and concurrent quality leadership were found to be the decisive points for the companies' success (Kinkel and Som 2007). Looking into the buyer supplier relationship, after intense studies on the question of identifying and pulling innovation from supplier to customer (Dyer and Singh 1998) also the inverse direction of pushing innovation from supplier to customer was researched (Monczka et al. 2010).

The necessity of supplier innovation integration to the customer product and process development is seen especially true in turbulent economic environment and rapid changes in the development of new products (Brem and Tidd, 2012; Johnsen et al. 2006). In an environment where the available product development time and own development resources decrease and the pressure on robust innovation increases at the same time, a significant contribution of innovation by suppliers is a necessary element for success

(Ragatz et al. 1997). Le Dain, Calvi and Cheriti (2011) explain in addition, that suppliers play a more important role in new product development with an increasing share of component outsourcing. Schiele (2010) shows that successful companies from an innovation standpoint intensively work with more than double the number of innovative suppliers than unsuccessful companies do. A prerequisite for successful innovation contribution from suppliers thereby is the early supplier involvement during the development activity on the one hand and the collaboration between purchasing and R&D department of the buying firm on the other hand. An additional aspect in this context was brought in by Rogers et al (2007), saying that new techniques in the buyer supplier management especially with regards to supplier development should be accompanied by e.g. supplier development workshops in order to mitigate institutional pressure on the buyer side and to achieve an effective and positive innovation result consistent with the buyer's institutional expectation. Another important question raised by academics was how to identify an innovative supplier (Schiele 2006). A "good" innovative supplier must first be motivated by the buyer looking at him as a preferred customer (Schiele 2012). The supplier must also have some potential resources in order to contribute in the development process. There is less unanimity about the origin of a potential innovative supplier. For Schiele (2006) the innovative must have a long history of collaboration with the buyer so implicitly he must be a part of the actual supply base of the buying firm. This most suits when the client is seeking for some incremental innovation (Azadegan 2011) but for Philipps et al. (2006), in a more discontinuous innovation context, an innovative supplier must be found mainly out of the supplier base outside the existing supply network by means of strategic dalliances in order to introduce some real novelties in the product.
If a lot of researches are trying to define the key managerial skills to successfully involve suppliers in these development activities (Wynstra 2003; Johnsen 2009), there is nothing said about how to practically compare offers received in order to select the more valuable one? If you really involve early suppliers in the NPD process the question is absolutely not trivial because the earlier you involve them, the less comparable should be their offers. Independent of the question how a supplier offering should be valued under the aspect of innovation in an early stage, early supplier involvement reduces the likelihood of supply disruptions in the future and hence reduces the perceptions of supply risk at the buying company (Zsidisin G.A., Smith, M.E. 2005)

To understand de construction of the comparative model describe in this paper we have to introduce you our perception of the main pitfalls inherent to the management supplier innovation.

Pitfalls in innovation management with suppliers

The target of the authors is to create a model that allows practical application, e.g. in an industrial environment. In this regard, the practical pitfalls and respective countermeasures have to be addressed as well when pursuing innovation management with suppliers.

The first practical pitfall for the purchaser when he is expecting innovation contribution from suppliers is that the suppliers normally have to be selected in an early project phase. As the supplier hardly can be changed in a later project phase, competition needs to be ensured before the collaboration phase between the selected supplier and the customer. As during that decision time the final product design logically is not fixed yet, the

technological dimension needs to be added to the sourcing concept of the buying firm (Schupp 2004).

This aspect needs to be emphasized as many purchasing organizations look for lowest possible product prices, good quality and high delivery reliability first, but they do not explicitly include technology or supplier innovation contribution to their primary target matrix (Schumacher et al. 2008). In this context Glantschnig (1995) asked member companies of the German Association of Materials Management, Purchasing and Logistics what are their main purchasing targets. The answers were lowest possible price, a good quality and a high level of delivery reliability. Grochla et al. in addition introduced the target of cost reduction (Grochla and Schönbohm 1981). Dobler et al. (1995) list similar targets of the Purchasing and Logistics function. This target focus shows, that purchasing organizations do not primarily strive for supplier contributed optimized designs and technological fit with the needs of the buying firm or the end customer. The purchasing organizations also do not necessarily work towards an optimized product-price allocation for items that they buy.

Schumacher et al. (2008) however, show in their study about the main leverages in purchasing that the product optimization has the biggest leverage on the bottom line of a company. Compared to this technical leverage, pooling of demand, global sourcing and process improvement have significantly less contribution. A good relationship between customer and supplier however results in significant improvements to the bottom-line as well. As a result, the study suggests that the target of product optimization should be added as one important element to the targets of a purchasing organization.

Therefore, the authors of this chapter conclude that the technology dimension itself needs to be added to the sourcing concept of the buying firm.

A second pitfall is the wrong or missing determination of functional preferences related to respective reservation prices of the customer or target prices of the customer's customer**.** In a business-to-business environment, hereby the target price of a supply chain transaction primarily is determined by the customer of the buying firm.
The competition phase of a sourcing process can have one or multiple winners that in many cases will start with the product development process after the awarding. If the market rules do not allow significant re-negotiations with the customer of the buying firm after project awarding, especially in cases where a high degree of innovation is required, the probability for a single source supplier is high. At the same time the risk for future financial loss incurred by the winning supplier is equally high. The latter is widely described under the phenomenon of the winner's curse. Here the winning bidder in a First-Price-Sealed-Bid auction tends to overestimate the unknown value of the auction object or underestimates the cost and consequently bids too optimistically. As a consequence the winner of the sourcing risks ending up with systematically limited margins or even with losses. Of course this phenomenon only occurs with bidders that act irrationally, but in business practice this situation happens from time to time. Literature analyses two main influencing factors (Engel et al. 2006). The first one states that the higher the number of bidders, the higher the risk for the occurrence of the winners curse. This aspect is widely accepted to be true. The second factor is the degree of uncertainty. Uncertainty for the supplier can arise from unclear technical aspects, from an undefined business volume or business environment or from changing expectations with regards to technological requirements.

As a recommendation for the buying firms' purchasing organization this means that in case of absence of post-sourcing re-negotiation possibilities with the buying firm's customer, the determination of functional preferences together with different reservation prices for respective functional product characteristics is necessary in order to eliminate the risk of financial loss by wrong product-price allocations.

A third pitfall in innovation management with suppliers is to close the design at a too early stage. To reduce the risk of product failure, the buying firm tends to wanting to specify product parameters in a very precise way from beginning of the project. If the buying firm does that, three types of risk can occur. The first one is a missed chance for innovation in an unexpected area. This could for example happen if a not awarded supplier could have reached superior product-price combinations in comparison with the winning supplier, but simply could not show his capabilities because of restricted product definitions in the beginning. Another risk could be that the selected supplier turns out to have technological disadvantage or even performance problems to achieve the specified product parameters if he is out of his technological sweet spot. A further risk is a non-optimized product-price combination which could lead to an overshooting of previously defined target cost or a wrong product-price allocation. The winning supplier could have been in a position to offer a better product for the same price or a less advanced product with an over-proportionally lower price. All such risks result out of ignored or simply unused supplier core or best-cost competencies in product or process innovation. Therefore it is evident for the buying firm to keep the own design open and to start with a functional specification rather than with a finalized design both on customer product and on sourcing object level.

A forth pitfall when trying to sustainably buy innovation is the rewarding problem. As the potential suppliers have to submit new technologies, own technical solutions and innovations, they must be rewarded for innovations that are used in final designs instead of the buying firm using and internalizing the innovation and sourcing it at another competing supplier. Therefore, the sourcing process has to run simultaneously over the technology dimension and the price dimension in order to avoid that the buying firms' preference is updated with the different supplier innovation contributions before the final sourcing. Otherwise the rewarding of innovative suppliers is endangered. Therefore, it is recommended to run an innovation sourcing process as a parallel process over the two dimensions price *and* technology.

Purchasing model for sourcing of utility-price combinations

The idea behind the present purchasing model is to create a solution space of possible product-price combinations instead of focussing on a fixed set of functional product characteristics or a fixed specification. In this way, the potential suppliers have the chance to introduce different technical and functional solutions that lead to several different product-price combinations. To guide the reader through the model, a reference to a practical example is used. In the example the buying firm intends to buy a display for a rear seat entertainment system to be sold to a customer that is producing passenger cars.

The model is based on a three-step concept. In the first step the user is defining his preferences. The second step creates the possible product-price combinations offered by the potential suppliers and the feasibility curve. In the third step the feasible product-price combinations will be put in context with the preferences of the buying firm. Orientated at

the value added of the product-price combination offered in relation to the preference curve and under the condition of the customer target price, an optimal supplier decision can be taken. By definition the term ‘product’ is used in the sense of the component or service to be purchased from the suppliers.

A developer’s survey reveals most important product attributes and characteristics

The development of the preference curve starts with a survey amongst the buying firms’ key development and marketing staff identifying the relevant attributes of the targeted product or components to be purchased.

Table 1: The buying firm sets relevant attributes and characteristics

Source: own

Ranking	Attributes		Characteristics	
1.	A1	Display Size [inch]	A1.1	7
			A1.2	10
			A1.3	12
2.	A2	Display Weight [gram]	A2.1	800
			A2.2	500
			A2.3	300
3.	A3	Electricity Consumption [w att]	A3.1	10
			A3.2	6
			A3.3	4
4.	A4	Response Time [ms]	A4.1	3
			A4.2	2
			A4.3	1

For each selected attribute possible characteristics have to be defined. In the model it is suggested to use 4 attributes and 3 characteristics for each attribute. The possible number of combinations equals to the number of characteristics to the power of the number of attributes (here $3^4 = 81$ combinaisons). Of course one can choose to increase or decrease the number of attributes and characteristics, however the chosen number of 4 and 3 gives enough possibilities and at the same time limits the complexity to a practical level. Another argument for limiting the number of characteristics is, that during the evaluation of the preferred and the feasible product-price combinations, an interpolation between the different combinations will be done. In the chosen example the attributes display size, display weight, electricity consumption and response time are used to characterize the purchased product.

Ranking of the top 10 product stimuli

In the next step the buying firm is requested to rank the best 10 product stimuli. Best in the sense of the model means the preferred combinations. Each stimulus consists of one characteristic per attribute.

Table 2: Ranking of stimuli according to preference and likelihood of acceptability

Source: own

Ranking	Characteristics for Attribute A1	Attribute A2	Attribute A3	Attribute A4	Reservation Price
1.	12	300	4	1	100
2.	12	500	4	2	98
3.	12	500	4	3	93
4.	12	300	6	2	85
5.	12	500	6	2	83
6.	12	500	6	3	80
7.	10	300	4	2	79
8.	10	500	4	3	76
9.	12	800	10	3	74
10.	10	500	6	3	73

In the example the best combination is a 12 inch display with 300 grams weight, 4 watts electricity consumption and 1 ms response time. Key in this development step of the preference curve is to assign a reservation price to each stimulus. The reservation price is the maximum price that the buying firm is willing to pay for the respective stimulus. As the stimuli are ranked, the highest reservation price will be found at the top ranked stimulus. Table 1 lists 10 stimuli for good visibility. Of course theoretically all 81 stimuli would be listed, but for the purpose of easier handling only the first 10 stimuli are used in the model going forward.

The setting of attributes and characteristics and also the ranking of the stimuli in business practice is only efficient with the help of digitalization. One or more stakeholders, mostly development engineers and marketing specialists, can define attributes with characteristics and rank them via a web-based tool. Out of the product planning or controlling group of the buying firm, the respective reservation prices can be added.

Conjoint analysis of stimuli and transformation into standard utilities

Step three in the development of the preference curve is the conjoint analysis itself of the stimuli. The method of the conjoint analysis identifies the importance of each attribute and characteristic (Luce and Tukey 1964). In the conjoint analysis, each attribute will receive an importance in percent totalling to 100 percent. Within each attribute, for the defined characteristics a utility value is calculated. By normalizing the values, the least important characteristic within an attribute gets assigned to the standard utility of 0. The highest valued characteristic gets assigned to the weight of the complete corresponding attribute. It is needless to say that also this step profits from digitalization over a web-based tool.

Table 3: Calculation of the utility value by conjoint analysis

Source: own

Attributes		Importance in %	Characteristics		Standard Utility
A1	Display Size [inch]	50	A1.1	7	0.000
			A1.2	10	0.200
			A1.3	12	0.500
A2	Display Weight [gram]	25	A2.1	800	0.000
			A2.2	500	0.200
			A2.3	300	0.250
A3	Electricity Consumption [watt]	20	A3.1	10	0.000
			A3.2	6	0.050
			A3.3	4	0.200
A4	Response Time [ms]	5	A4.1	3	0.000
			A4.2	2	0.030
			A4.3	1	0.050
	∑	100%			

Ranking of the best 10 stimuli by utility and reservation price

In step four the standard utilities out of step three are used to calculate the utility of each stimulus. The calculation is simply adding the standard utilities of each characteristic within the 10 selected product stimuli. By the method of normalization the maximum value of a stimulus utility is 1. The minimum is 0.

Table 4: Referencing of reservation price and utility of 10 best stimuli

Source: own

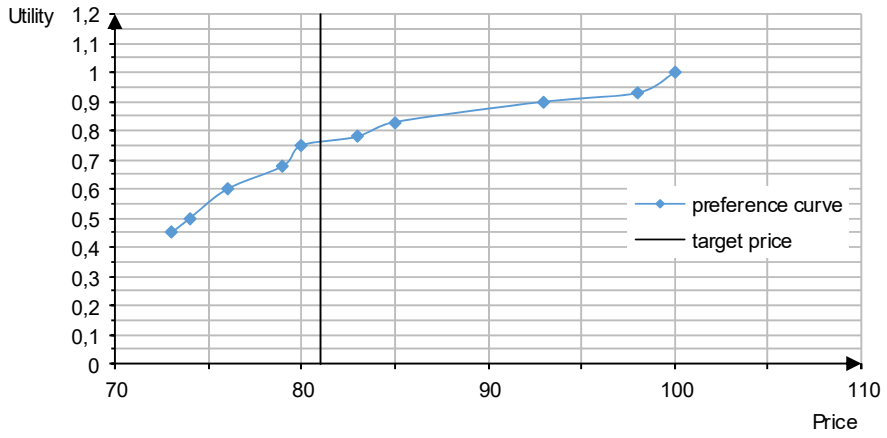
Ranking	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Utility Stimulus	1.000	0.930	0.900	0.830	0.780	0.750	0.680	0.600	0.500	0.450
Reservation Price	100	98	93	85	83	80	79	76	74	73

In step five of the preference curve creation, the reservation price for each stimulus and the utility of the same stimulus are put in context by entering both in a graph. The reservation price is put down on the x-axis, the utility on the y-axis. The final selection for a product-price combination in business practice does not only depend on the reservation price of the buying firm, but also on the target price of the buying firms' customer. This customer target price is introduced to the model at this point.

Of course it can happen that some acceptable stimuli from a buying firms' point of view have higher reservations prices compared to the customer target price. This situation will be discussed further after the development of the feasibility curve with regards to offered product-price combinations by the potential suppliers.

Table 5: Matching of utility and reservation prices to the preference curve

Source: own



Development of the feasibility curve based on supplier innovation

Based on an open functional specification, the potential suppliers are asked to offer their product-price solutions to the buying firm. In a concept competition each potential supplier is asked to offer several possible product solutions that also can have different prices.
The first step for the development of the feasibility curve uses the utility values of the characteristics defined in the development of the customer preference curve before.

Table 6: Supplier offers translated in utility values and related offered price

Source: own

Offer	Supplier	Utility A1	Utility A2	Utility A3	Utility A4	∑ Utility	Price
1	A	0.400	0.200	0.200	0.050	0.850	105
2	C	0.400	0.150	0.200	0.030	0.780	100
3	B	0.300	0.250	0.200	0.020	0.770	94
4	A	0.550	0.200	0.000	0.000	0.750	85
5	A	0.350	0.250	0.050	0.050	0.700	83
6	B	0.400	0.150	0.100	0.030	0.680	80
7	C	0.200	0.350	0.100	0.000	0.650	79
8	B	0.500	0.100	0.000	0.000	0.600	76
9	C	0.200	0.100	0.000	0.050	0.350	75
10	B	0.100	0.100	0.000	0.030	0.230	72

If suppliers offer characteristics that do not match with the selected characteristics by the buying firm, the model will interpolate the utility values of the offered and the selected characteristics. The utility values of each characteristic are added to a sum of utilities. In addition to the utility sum of the offered stimuli by the suppliers, the corresponding offering price is included in the model. As mentioned before, suppliers might offer new product attributes that are decision relevant. If so, the steps 1 to 5 of the model have to be repeated.

Utility-price ranking of the 10 best bids

The next step of the model is the negotiation between the buying firm and the competing suppliers.
Different to conventional negotiation situations the suppliers can either offer better prices or better utilities. The latter can be done by offering better characteristics compared to the previous solution. This process can also lead to a situation where the utility value will increase and the price will increase as well. In the example this situation is shown by supplier B who is offering 100 € and a 0.930 utility in offer number 3 compared to 94 € and 0.900 utility in offer number 2. The format displayed allows three rounds of negotiation. Nevertheless more rounds are possible in real business situations.

Table 7: Three offer rounds allow price and utility changes

Source: own

	Offer 1			Offer 2			Offer 3		
Supplier	Utility	Price	Feedback	Utility	Price	Feedback	Utility	Price	Feedback
A	0.850	105	r	0.880	105	r	0.950	105	r
B	0.780	100	r	0.900	94	r	0.930	100	r
C	0.770	94	r	0.900	95	r	0.900	94	r
A	0.750	85	r	0.850	84	g	0.890	85	g
B	0.700	83	r	0.830	84	g	0.860	83	g
A	0.680	80	r	0.740	78	g	0.820	80	g
C	0.650	79	r	0.680	77	g	0.800	79	g
B	0.600	76	g	0.700	79	g	0.700	76	g
C	0.350	75	r	0.400	73	r	0.400	73	r
B	0.230	72	r	0.350	75	r	0.330	72	r

For each negotiation round a feedback is required. The feedback indicates if the offered product-price combination is above or below the preference curve of the buying firm. If the offered product-price combination is above the preference curve, the feedback is ‘g’ for green. The meaning is, the product-price point is inside the area of acceptable solutions for the buyer. The feedback ‘r’ for red indicates that the offered solution is not acceptable for the buyer as it is below his preference curve.
In this element of the model digital feedback to the suppliers allows to start immediate improvement actions by the suppliers to put themselves in a better position in the following round of negotiation.

Winner determination by comparing for preference and feasibility curve

In the following step the winning combinations are listed. Winning combinations are defined as the combinations after the final negotiation round with the feedback green.
If the result of the negotiation has more than one winning combination, another two steps to determine the best solution have to be taken.
First the offered prices of the winning combinations have to be mirrored against the buying firms’ customer target price. In general it can be assumed that an acceptable solution for the customer has to beat his target price. Nevertheless there might be situations where a customer would be willing to discuss an attractive utility-price combination that is even above his target price. Such a situation could occur if e.g. a customer has a product placing strategy for low end and high end market segments at the same time.

Secondly, the question needs to be answered which one of the winning combinations is the best combination out of the buyer's point of view.

Table 8: Identification of the utility delta between feasibility and preference curve

Source: own

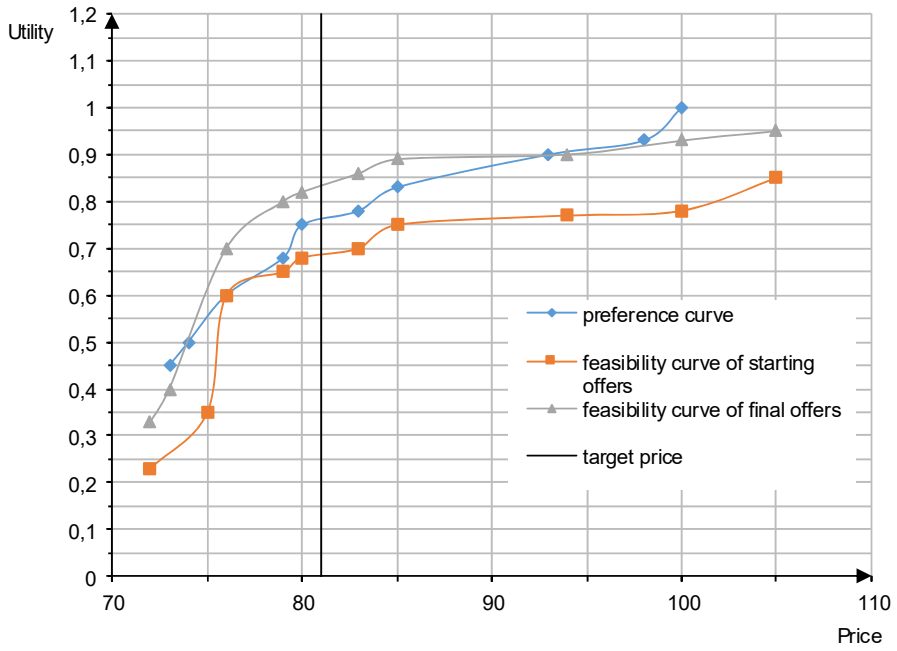
Supplier	Price	required Utility	offered Utility	Δ (offered - required) Utility	above/ below Target Price
C	79	0.680	0.800	+ 0.120	below
B	76	0.600	0.700	+ 0.100	below
B	83	0.780	0.860	+ 0.080	above
A	80	0.750	0.820	+ 0.070	below
A	85	0.830	0.890	+ 0.040	above

In the example 3 winning combinations have a utility of 0.8 at a price of 79 €, a utility of 0.7 at a price of 76 € and a utility of 0.82 at a price of 80 €. If the buyer would choose the winning combination with the lowest price he would decide for a utility of 0.7 at a price of 76 €. But as the target of the model is to identify the best offer based on price *and* utility, the buyer could choose the winning combination with the highest delta utility towards the preference curve. With this argument the combination with the utility of 0.8 and the price of 79 € would be the best combination. In order to identify such kind of best utility-price combinations, all feasible solutions above the preference curve are listed and ranked by their delta utility to the preference curve. Table 8 shows which combinations are below or above the customer target price. In table 9, the presented example is aggregated into the preference curve and a feasibility curve before and after negotiation in one graph.

By the introduction of the target price line of the buying firms' customer, the user of the model can identify the relevant winning solutions. As mentioned above also the two other green utility-price combinations are element of the solution space of the model. They are above the target price line of the customer's customer, but represent high enough utilities. Therefore, the customer might offer an upgrade product to the customer's customer that he could sell to a higher end market.

Table 9: Feasibility curve of final offers in context with target price and preference curve

Source: own



Conclusion and future research directions

The present model shows how to effectively include the technology dimension into sourcing decisions where a supplier contribution with regards to innovation is required. The model is created for the use in business practice. It allows systematic early supplier involvement without losing the competition phase and can be applied for innovation management with suppliers in different sectors and used for various products. A transformation from product to component level is possible as in such cases the product innovation would be gradually replaced by process innovation. In the next development step for the effective application, digital buying portals or buyer-supplier platforms have to be enhanced so the buying firm can process the technology dimension by entering attributes, characteristics to get to product stimuli and to get to calculated corresponding utilities. Invited suppliers can set their bids in form of utility-price combinations and get real-time feedback about their ranking in the negotiation. If the customer of the customer can be linked to the portal as well, the target prices of the customer's customer can be used in order to allow real-time decision making that is including even the solution space above the customer's customer target price.

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Supplier involvement in new product development in the public sector: Evidence from public procurement of R&D in the UK

Kostas Selviaridis & Martin Spring
Department of Management Science
Lancaster University Management School
LA1 4YX, Lancaster, United Kingdom
Email: k.selviaridis@lancaster.ac.uk; m.spring@lancaster.ac.uk

Abstract: This paper investigates supplier involvement in new product development (NPD) driven by public procuring organisations. It stresses the role of small suppliers in leading the development of products that fulfil unmet public sector needs. Under high technological uncertainty, innovative SMEs can assume NPD responsibility at product level. Contracts for product development contribute to the establishment and growth of innovative small suppliers which, in many cases, would not otherwise exist. This supply network creation function is in stark contrast with supplier involvement in NPD occuring in pre-existing supply networks.

Keywords: Supplier Involvement in NPD; Pre-Commercial Procurement; R&D Contracting

Submission category: Working paper

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Introduction

The aim of this paper is to investigate supplier involvement in new product development (NPD) that occurs in the public sector. The extant literature on supplier involvement in NPD has collectively shown that suppliers are an important source of innovation and can positively contribute to a focal firm's NPD performance (Johnsen, 2009). However, empirical research in this area has focussed on private sector buyers (typically large manufacturers) and their relationships with established suppliers of component or systems, and has ignored settings whereby the buyer is a public organisation.

Besides its focus on private sector procuring firms, the extant literature too often regards the procuring firm as the end user of the sourced innovation. Suppliers tend to contribute to well-defined specification, design and development tasks, and to be involved in specific stages of the NPD process depending on certain contingencies e.g. criticality of component and complexity of development task (Zhao et al., 2014). The depth of supplier involvement is characterised by supplier level of responsibility for development activities (e.g. 'black-box' suppliers), but such responsibility stll refers to components, sub-assemblies or systems that are integrated into the focal firm's new product (Wynstra et al., 2010).

These underpinning assumptions, which remain largely implicit, are often not appropriate in innovation-oriented public procurement settings. Public authorities also conduct sizeable R&D and invest in developing new products and technologies that have the potential to improve the delivery of public services. Internationally, a well known example is the US Defence Advanced Research Projects Agency (DARPA). Notable examples in the UK include National Health Service (NHS) England with its various related initiatives, and the Defence Science and Technology Laboratory (DSTL) operating within the UK Ministry of Defence (MoD). Similar

to developments in the private sector, such public organisations increasingly draw on industry suppliers' R&D capabilities and inputs to improve NPD performance in terms of reduced development time and costs. In such settings, the public procuring organisation may not be the end user of the new product. For instance, in UK healthcare patients are often the users of many digital medical apps that are mainly developed by industry suppliers and subsequently procured by NHS agencies. This example also suggests that suppliers may be asked to assume NPD responsibility at product level, although such products /technologies still need to be integrated into the wider service delivery system. Understanding how suppliers are integrated into public sector-oriented NPD is important, given the significant challenges in relation to the adoption of innovative products or technologies by public sector customers (Georghiou et al., 2014).

Overall, we seem to know little about supplier involvement in NPD in innovation-oriented public procurement settings. This study aims to improve our understanding by pursuing the following research question: How *does supplier involvement in NPD differ in innovation-oriented public procurement settings as compared to private sector innovation procurement?*

We address this question through a qualitative interviewing study. Our empirical focus is on the Small Business Research Initiative (SBRI), which is the UK policy instrument for public procurement of R&D. The SBRI targets private sector suppliers (especially SMEs and micro-companies) to be involved in the development of new products /services that fulfill unmet public sector needs. Our study identifies some distinguishing characteristics of supplier involvement in NPD in the context of innovation-oriented public procurement. It also identifies some novel research avenues at the intersection of research on "supplier involvement in NPD" and the "innovation-oriented public procurement".

Literature review

Supplier involvement in new product development

The literature on supplier involvement in NPD has grown considerably in the last two decades as there is recognition of the potential of suppliers as a source of product or process innovation (Johnsen, 2009). This reflects, more broadly, the wide adoption of the open innovation paradigm which suggests that a focal firm's innovation performance is increasingly dependent on interaction and collaboration with its customers, suppliers and business partners (Chesbrough, 2006). Supplier involvement in NPD refers to the integration of capabilities that suppliers can contribute to R&D projects of a focal organisation. Van Echtelt et al. (2008, p. 182) define supplier involvement in NPD as *"the resources (capabilities, investments, information, knowledge, ideas) that suppliers provide, the tasks they carry out and the responsibilities they assume regarding the development of a part, process or service for the benefit of a buyer's current or future product development projects".*

Early research on supplier involvement in NPD was biased towards the automotive industry (Johnsen, 2009), showing how Japanese auto manufacturers coordinated R&D and procurement tasks internally, and how they leveraged supplier capabilities to reduce time-to-market and improve product quality (Clark and Fujimoto, 1991). Although subsequent empirical research expanded into other industrial sectors, a common denominator of the existing literature is the focus on private sector manufacturers as the focal firms that involve, integrate and collaborate with their suppliers in NPD projects (Luzzini et al., 2015).

Existing research has emphasised a number of aspects that could be distilled into antecedents, process, and performance effects of supplier involvement in NPD. Antecedents of supplier involvement refer both to drivers of supplier integration and pre-conditions for successful

integration. Key drivers include increased market competition, rapid technological change, reduced product life cycles and the need to reduce drastically time to market. Several prerequisites of supplier involvement in NPD have been discussed in the literature, such as prior experiences with suppliers, supplier relationship quality, supply base rationalisation and supplier selection based on technical and R&D capabilities (e.g. Koufteros et al., 2007; Yeniyurt et al., 2014; Sjoerdsma and van Weele, 2015).

Process-related issues include the extent and appropriate timing of supplier involvement. Regarding the extent or depth of involvement, a distinction is typically drawn between 'black-box' and 'grey-box' supplier integration into NPD. The former refers to cases where the supplier assumes sole responsibility for developing a certain component or part, whereas the latter in circumstances where the supplier works jointly with the buyer and shares its expertise, but it does not assume sole responsibility for component development (Koufteros et al., 2007). Regarding the timing of supplier involvement in NPD, it is suggested that optimal timing depends on several factors including the criticality of component, the supplier's strategic importance and the complexity of development task (Zhao et al., 2014).

Overall, *early* supplier involvement is beneficial insofar as it helps to evaluate the technical feasibility of new concepts and to reduce the cost of changes in product design and engineering specifications. Recent studies stress the importance of focusing on supplier involvement in the "fuzzy front-end" as compared to involvement in the "execution-oriented back-end" (production to product launch) of the NPD process (Wowack et al., 2016). Supplier involvement in the fuzzy front-end is influenced by relationship characteristics (e.g. benevolence) and, when effectively managed, it can lead to significant performance benefits (Schoenherr and Wagner, 2016). Other studies stress the importance of developing a structured approach to supplier involvement and effectively managing supplier relationships (e.g. Van Echtelt et al., 2008). To this end, the positive contribution of supplier development activities has been stressed (Lawson, Krause et al., 2015). However, existing research tends to focus on dyadic (buyer-supplier) relationships and has yet to systematically consider supplier network-level effects (for a notable exception see Johnsen, 2011).

In terms of performance effects, empirical evidence collectively suggests that effective management of supplier involvement in NPD contributes to reduced development time and costs and quality enhancment (e.g. Lawson, Tyler et al., 2015; Van Echtelt et al., 2008). There are, nevertheless, several caveats to this generic conclusion depending on specific contingent factors. For instance, there is inconclusive evidence of whether involvement of existing suppliers is beneficial under high technological uncertainty and radical innovation scenarios. In such contexts, it may be more effective to involve new suppliers as a potential source of innovation (Johnsen, 2009).

Innovation-oriented public procurement

The literature on public procurement of R&D and innovation (Georghiou et al., 2014) originitates in the field of innovation policy and management and it has developed very much in parallel with research on (private sector) innovation sourcing and the more specific literature on supplier involvement in NPD. Research on innovation-oriented public procurement has focused on the enabling role of goverment procurement in stimualting innovation in supply markets (Aschhoff and Sofka, 2009). Public procurement is regarded as a distinct type of demand-oriented innovation policy instrument, which can steer the development of new products or technologies that address grand societal challenges and meet operational needs of public authorities (Edler and Georghiou, 2007). Public organisations essentially serve as lead

customers of innovative products or technologies, thus creating demand for and incentivising R&D and innovation that would not otherwise happen. The potential of goverment procurement has also been recognised in the UK, where approximately 14 per cent of GDP is spent on public procurement (HM Government, 2017).

The literature discusses two key types of innovation-oriented public procurement (Edquist et al., 2015). ”Pre-commercial procurement” concerns public procurement of R&D services that may trigger demand for yet-to-be-tested products or technologies. ”Public procurement for innovation” refers to commercial procurement of products or technologies that have already proven their benefits (Edler and Yeow, 2016). By virtue of its emphasis on early-stage, highly uncertaint R&D, pre-commerical procurement does not include commercialisation and innovation adoption tasks. Rather, private sector suppliers are awarded R&D contracts ultimately with the aim of developing and demonstrating a prototype which is to be further tested and refined. A separate procurement process is subsequently initiated to procure the final product or technology at large scale (Ribgy, 2016).

From a policy perspective, pre-commercial procurement is expected to perform three high-level functions (Selviaridis and Spring, 2017): (a) addressing market failures - of information by showcasing promising supplier products /technologies and helping suppliers (especially SMEs) to attract additional funding, and those related to positive externalities of R&D by incentivising industry effort and investment in highly uncertain NPD activity, (b) addressing system failures by facilitating connectivity of all relevant actors, promoting interactive learning and articulating and coordinating demand for innovative solutions, and (c) allowing public organisations to solve hitherto intractable problems by acting as lead customers that help create markets for new products /technologies.

A notable example of pre-commercial procurement is the US Small Business Innovation Research (SBIR) programme. This been in operation since 1982 with the purpose of developing new products or technologies that address the needs of federal departments and other public agencies. Overall, the SBIR has had a positive impact on the US economy and the growth of innovative SMEs (Mazzucato, 2015). Pre-commercial procurement policies in Europe originate in attempts to imitate the US SBIR scheme. First the UK in the early 2000s, and later the EU developed specific policies for public procurement of R&D (Rigby, 2016). The EU policy framework for pre-commercial procurement is compliant with principles of equal treatment and fair competition and avoidance of state aid. Currently, three pre-commercial procurement schemes operate in Europe: the UK SBRI, the Dutch SBIR and the Flemish Procurement of Innovation scheme designed by the Government of Flanders in Belgium (Apostol, 2014).

Research method

To develop an understanding of how suppliers are involved in public sector-driven NPD activity, and how different that is from what we already know about supplier involvement in NPD in the private sector, we have adopted a qualitative research design based on in-depth interviews (Marshall and Rossman, 1999). We have chosen to focus on the UK SBRI as that is the country’s main mechanism for involving private sector suppliers in public-sector-driven R&D activity. In addition, the UK SBRI is mainly concerned with development projects characterized by: (a) moderate-to-high technological uncertainty and, (b) potential involvement of multiple supply network tiers (SMEs and larger, first-tier suppliers to public authorities) in NPD. These characteristics make a comparison of the SBRI with supplier involvement in private sector innovation sourcing theoretically interesting.

Data collection entailed 32 semi-structured interviews with individuals who are knowledgable about the SBRI process as well as review and analysis of 80-plus documents. More specifically, we conducted interviews with 20 supplier companies /SMEs that have participated in SBRI competitions and related R&D projects, and four public organisations using the SBRI scheme to involve suppliers in NPD activity. We also conducted eight interviews with innovation /innovation procurement experts and relevant policy makers e.g. from the Department of Business, Energy and Industrial Strategy and Innovate UK. The interviews covered multiple areas such as the rationale and aims of the SBRI scheme, its implementation in practice, procurement process aspects, supplier involvement in SBRI projects, and the effectiveness of the SBRI scheme.

To complement and triangulate interview data, we collected and analysed publicly available data including SBRI review reports, Innovate UK reports, official statistics on SBRI competitions and contracts awarded, as well as policy-oriented reports produced by innovation experts and international organisations e.g. OECD. We used the ATLAS.ti software to organise, analyse and code both primary and secondary data. In parallel to assigning codes to interview transcripts and document excerpts using open and axial coding procedures (Miles and Huberman, 1994), the 'memo manager' function of ALTAS.ti was used to capture our evolving thoughts and comments during the data analysis process. Our (comparative) analysis also drew on key concepts featuring in the literature on supplier involvement in NPD. This allowed us to identify some distinguishing characteristics of supplier involvement in public procurement of innovation settings.

Findings

The Small Business Research Initiative (SBRI): scope and process

The SBRI is a horizontal (i.e. sector-neutral) policy instrument that provides opportunities for public sector organisations and innovative companies to interact and engage in collaborative R&D to solve specific challenges facing the UK public sector. Unlike the US SBIR that allows only small businesses (with maximum 500 employees) which are also at least 51% commercially owned to bid for government R&D contracts, the UK SBRI is accessible to any organisation of any size, including large firms, consultancies and even universities. This is because the UK SBRI complies with EU legislation that does not allow for preferential treatment of small suppliers, and thus it cannot prevent larger firms from taking part in pre-commercial procurement and being awarded government R&D contracts (Ribgy, 2016). The scheme's lack of exclusivity to small suppliers is also based on the expectation that SBRI contracts are not attractive to large firms because these companies can self-fund R&D activities of that scale without having to expose their innovative ideas to other organisations. According to a SBRI Account Manager from Innovate UK, approximately three quarters of all SBRI contracts have been awarded to SMEs. The SBRI employs a phased approach meaning that suppliers /SMEs effectively tender for successive R&D service contracts (see Figure 1).

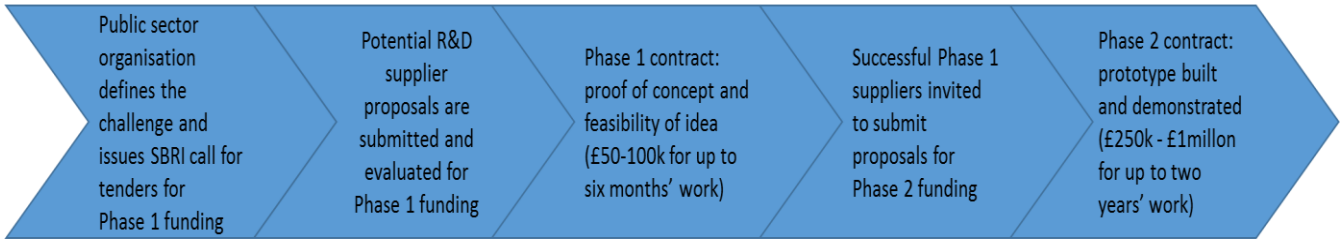

Figure 1: An overview of the SBRI process

The process starts with the identification and definition of a specific need or problem facing a public organisation, which is subsequently responsible for drafting the challenge brief and issuing the call for tenders. All tenders at that stage concern *Phase 1 contracts for 'proof of concept' research*. Supplier proposals are evaluated, and the successful ones are awarded Phase 1 contracts. These are worth £50-100k on average and last up to six months. These projects are expected to establish the scientific, technical and commercial feasibility of the innovative idea. Companies that successfully complete Phase 1 contracts can then be invited to tender for *Phase 2 contracts for prototype development*. Suppliers awarded Phase 2 contracts engage in prototyping activities and are expected to build, test and demonstrate a prototype. This work typically lasts up to two years and is worth up to £1 million. Successful Phase 2 projects may proceed to be further tested and subsequently procured and adopted by customers in the public or private sector.

Some SBRI projects (e.g. SBRI Healthcare) may informally include a third phase where the product or technology is further tested and refined in collaboration with potential customers in the public or private sector. However, this is the exception rather than the norm and there is no formal provision for a Phase 3 contract and related funding for commercialization activities.

The SBRI and supplier involvement in public sector NPD: some distinctive characteristics
This section discusses a number of seemingly distinctive characteristics of supplier involvement in public sector-driven NPD projects (see Table 1). These features result from analysis of the UK SBRI and comparison to extant literature on supplier involvement in NPD.

Table 1: Distinctive features of supplier involvement in NPD in the context of the UK SBRI

Dimensions for distinctiveness	**Distinctive characteristics**
Rationale for supplier involvement	Incentivizing supply base involvement in high-risk NPD; supporting growth of innovative small suppliers
Technological uncertainty impact	Focus on low-maturity technologies /products and involvement of new suppliers (innovative SMEs)
Supplier responsibility	Suppliers in many cases assume development responsibility at product level. They are heavily involved and usually lead fuzzy front-end NPD
Appropriation /intellectual property	Suppliers retain intellectual property even at product level
Supplier selection process	Suppliers compete on 'challenges' based on a tournament logic: evaluation of relative performance in focus
Supply network mobilization and creation	Mobilizing multiple supply network tiers in NPD; enabling creation of new suppliers
Innovation ecosystem complexity	High complexity impedes interactive learning and creates new product adoption and integration challenges

Regarding the rationale for supplier involvement, motivation extends beyond improving NPD performance in terms of reduced development time and cost. Early stage public sector R&D is highly uncertain in terms of its returns and it is prone to positive externalities and spillover effects, which discourages private sector participation and investment. Pre-commercial procurement schemes (such as the SBRI) incentivize suppliers to be involved in fuzzy front-end NPD activities by articulating demand for new products or technologies. In other words, public organisations serve as lead customers of new products that have the potential to fulfill unmet needs. In addition, there is particular emphasis on encouraging the involvement of innovative small suppliers and supporting their growth via integration into NPD that is relevant to public sector needs.

SBRI projects focus on the development of low-maturity technologies or even 'things that do not exist yet'. In this context, development risks tend to be high. Under high levels of technological uncertainty, public organisations are keen to expand their R&D supplier network and engage with agile, innovative SMEs or micro-companies that have the potential for contributing novel ideas or solutions.

An inherent requirement of the SBRI process is that suppliers are heavily involved in, and in many cases lead, early stage NPD activities. These include generating solution ideas, defining the solution concept, establishing the technical and commercial feasibility of the proposed solution, and developing and demonstrating prototypes. In most SBRI Phase 2 projects, the selected suppliers assume development responsibility at the level of the final product, rather than at component level. Public organisations monitor progress against the contracted NPD activity and typically provide feedback and expert knowledge e.g. regarding potential public-sector applications. In projects that qualify for further testing (via an informal phase 3) the supplier then works closely with all relevant public organisations (which may be other than the R&D procuring agency) to refine the solution and pilot-test it in real-life scenarios. The SBRI mechanism stipulates that suppliers retain intellectual property rights related to the novel ideas and products they develop, although public procuring authorities can have rights to access technologies as appropriate.

The majority of SBRI competitions are designed as 'challenges', making use of outcome- or problem-based specifications. The suppliers compete to be awarded R&D contracts and they are evaluated based on their relative performance (i.e. how promising and feasible a solution is as compared to others). The phased approach to awarding R&D contracts (Figure 1) suggests that the reward gap between suppliers that are able to move their product /technology ideas forward (i.e. suppliers awarded Phase 2 contracts) and those that are not (i.e. suppliers that fail to proceed beyond Phase 1) is significant enough to incentivize supplier effort and resource investment. In addition, there are substantial long-term benefits for suppliers (particularly small firms) that win such challenge-based competitions. Innovative suppliers that successfully complete Phase 2 contracts and develop promising products enjoy reputation benefits and can attract additional funding (e.g. venture capital) to further support their NPD activity.

The SBRI process also entails mobilization and involvement of multiple supply network tiers in public sector-driven NPD. Innovative SMEs or micro-companies that successfully complete R&D contracts are connected to larger, well-established suppliers (to public organisations) and work with these large suppliers to further refine a new product /technology or identify alternative applications. In addition, first-tier suppliers (e.g. prime defence contractors or pharmaceutical firms) may be working closely with public agencies to scope and specify the requirements included in SBRI challenge-based competitions, essentially proving input into needs definition. Innovative SMEs developing promising products can either become second- or third-tier suppliers or supply directly their public-sector customer. In this sense, the SBRI scheme appears to facilitate the creation and growth of innovative small suppliers, thereby supporting the development of innovation capability at the supplier network level.

The depth and impact of involvement of such small suppliers depends on many contingent factors including their positioning in the value chain, the characteristics of specific products and markets and their business model. Regarding the latter, innovative small suppliers involved in public sector R&D contracts can be classified as product-based businesses and R&D consultancies. The former are suppliers that are willing to invest resources in public sector-

relevant NPD and to build a business based on specific products or technologies derived from such NPD activity. The latter category refers to suppliers that effectively sell product /technology development services to their customers and they are not necessarily interested in building their own product-based business.

Innovation ecosystems in the public sector (e.g. in the UK healthcare and defence) are highly complex, creating structural, institutional and behavioral barriers that limit the ability of innovative small suppliers to effectively promote their innovative solutions to relevant public authorities. Systemic complexity impedes interactions and learning: both amongst relevant public organisations involved at different stages of the NPD process (R&D units, procurement units and end users of new products /technologies) as well as between small suppliers and public organisations (as potential customers and users of new products). Weak interactions and limited collaboration in many cases create challenges regarding the integration of new products /technologies (developed via SBRI projects) into existing service delivery systems. For example, the introduction of new digital technologies into health and social care systems may require partial re-design of service process, which may well be resisted by clinicians. The equal treatment and competitive tendering ethos instilled in public procurement practice may also be contributing to weaker buyer-supplier collaboration in NPD activity, despite the fact that innovation-oriented procurement processes (such as the SBRI) are in theory designed to overcome such impediments.

Discussion and conclusions

This paper seeks to understand how suppliers are involved in NPD occurring in public sector contexts, and how that may differ from supplier involvement in private sector innovation procurement settings. The research has identified several seemingly distinctive characteristics of supplier involvement in NPD in the context of pre-commercial procurement (see Table 1).

The empirical study emphasises some features that the extant literature on supplier involvement appears to have underplayed. The case of the UK SBRI stresses the role and contribution of *small suppliers* to NPD. Further, the SBRI exemplifies how, under high levels of technological uncertainty, public procuring organisations draw on the capabilities of *new suppliers* and how they deliberately expand their R&D supply network beyond their established suppliers to tap into new ideas. In many cases of SBRI projects, 'new supplier' has an additional meaning: these are suppliers (micro) companies that have been founded *because of* being awarded R&D contracts and selected to participate in public sector-relevant NPD activity. The risks related to investing effort and resources in low maturity product /technologies are mitigated via the SBRI phased approach to contracting, which resembles well-known stage-gate models of the NPD process (cf. Veryzer, 1998).

As compared to supplier involvement in private sectors, suppliers to public authorities are not only heavily involved in fuzzy front-end NPD activities (Schoenherr and Wagner, 2016), but in most cases they also lead such activities. Similar to what we already know from the extant literature, supplier selection is based on a competitive process. However, what is distinctive in the case of SBRI is that such supplier competition appears to follow a tournament logic (Wowak et al., 2016) i.e. suppliers compete for development contracts on the basis of designed innovation 'challenges' and they are being evaluated based on the relative performance of their innovative solutions.

Overall, our findings extend the literature on supplier involvement in NPD in two ways. First, we stress the role of small suppliers which can have a leadership role in fuzzy front-end

activities of developing products that fulfil unmet public sector needs. Under high level of technological uncertainty in public sector-relevant NPD, innovative SMEs can assume R&D responsibility at product level, rather than being involved in specific stages of a NPD process tightly controlled by a focal manufacturing firm (e.g. Lawson et al., 2015). The innovation locus is often external to the public procuring organisation, whose role in such cases is to facilitate interactions among SMEs, large industrial suppliers and potential end users.

Second, we show that innovation-oriented public procurement schemes (such as the SBRI) can perform a function of supply network creation. Contracts for product development are instrumental in helping to establish and grow innovative small suppliers which, in many cases, would not otherwise exist. These product-based businesses in the making can potentially fulfill the needs of public sector customers or established (first-tier) suppliers to the public sector, depending on their value chain positioning and product and market characteristics. This supply network creation function is in stark contrast with private sector innovation sourcing that happens largely in pre-existing supply networks, and entails collaboration with established suppliers and buyer influence of the supply network in a top-down fashion (Johnsen, 2011).

More broadly, our study serves as a first step towards cross-fertilising in a more systematic way two hitherto unconnected literatures: ”supplier involvement in NPD” and ”innovation-oriented public procurement”. Although our research is still in progress and it has so far focused on pre-commercial procurement settings, we can already point at some relevant avenues for future research. Potential research questions include the following: (1) What are the different pathways or models through which suppliers can be involved in NPD driven by the public sector? (2) How is supplier involvement in NPD managed when public sector customers require incremental (rather than radical) innovations? (3) What are the key success factors for increasing the adoption of supplier-enabled new products /technologies by public sector customers? (4) What is the impact of supplier involvement in NPD on the performance of public services? We hope that this working paper will stimulate intellectual debate and encourage research on some of these topics.

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Reshoring drivers in a Swedish manufacturing context

Movin Sequeira[1], Per Hilletofth[2], David Eriksson[3], and Kristina Sollander[4]

1. Department of Industrial Engineering and Management, School of Engineering, Jönköping University, P.O. Box 1026, SE-551 11, Jönköping, Sweden, E-mail: movin.sequeira@ju.se
2. Department of Industrial Engineering and Management, School of Engineering, Jönköping University, P.O. Box 1026, SE-551 11, Jönköping, Sweden, E-mail: prof.p.hilletofth@gmail.com
3. Department of Industrial Engineering and Management, School of Engineering, Jönköping University, P.O. Box 1026, SE-551 11, Jönköping, Sweden, E-mail: dr.d.eriksson@gmail.com
4. Department of Industrial Engineering and Management, School of Engineering, Jönköping University, P.O. Box 1026, SE-551 11, Jönköping, Sweden, E-mail: kristina.sollander@ju.se

Abstract
The purpose of this paper is to investigate the contextual nature of reshoring drivers. This issue is examined through a multiple case study including three companies. Altogether, 49 sub drivers, categorized into 20 main drivers, were found in the case study. Among these, 40 were identified in the literature. All the main drivers, except 'government subsidies', were found in both the case study and the literature. This research proposes that the reshoring drivers are context dependent, that firm size seems to correlate to the number of drivers considered, and that Swedish reshoring seems independent of governmental subsidies.

Keywords: reshoring, drivers, manufacturing, Swedish context

Submission Category: Working Paper

Introduction

A significant movement of manufacturing from high- to low-cost environments, offshoring, has taken place in the past three decades (Ellram, 2013). This movement has created problems in the western world with regard to economic growth and employment (Wiesmann et al., 2017). The main reason for this relocation has been to reduce manufacturing cost, or more specifically the labor cost (Bunyaratavej et al., 2008). When looking in the rear-view mirror, it has become clear that many of these relocations have been unsuccessful; mainly due to the use of too simplistic calculations where the total cost was underestimated (Brown, 2010). In recent years, there has been an intensified discussion concerning the opposite movement, reshoring, that is when companies decide to move manufacturing back to their home country (Wiesmann et al., 2017). The manufacturing industry in the western world has shown an increased interest in reshoring, and more and more cases are starting to appear in both the scientific and the industry literature (Ellram et al., 2013). However, reshoring is still a young research area and has not been studied in a greater extent.

The existing literature in the reshoring field mostly focuses on investigating reshoring as the consequence of failed offshoring (Wiesmann et al., 2017). It has been argued that the manufacturing location decision often is based on vague grounds, and that managers feel that it is hard to find good support in the literature for these types of decisions (Arlbjørn & Mikkelsen, 2014). There is a need to study drivers from a locational and a supply chain perspective, including the initial offshoring decision in order to be able to explore how the location decision develops over time. The purpose of this study is to investigate the contextual nature of reshoring drivers. The research questions are as follows: (1) 'What are the reshoring drivers in a Swedish manufacturing context?' and (2) 'How do the reshoring drivers from the Swedish manufacturing industry differ from those in the existing literature?' To answer the research questions, a multiple case study was conducted including three case companies from the Swedish manufacturing industry.

Literature review

Reshoring is a relatively new concept and does not have a widely recognized definition. Several synonyms are used in the literature, including backshoring, inshoring, and back-reshoring (Wiesmann et al., 2017). Reshoring, as a concept, is also seen in different ways and have developed over time. According to Gray et al. (2013), reshoring is fundamentally a location decision, and Tate et al. (2014) state that reshoring is the relocation of manufacturing from an offshore location to a more attractive location or to the home country. In this study, reshoring is seen as a location decision, where previously offshored manufacturing is moved back to the home country. Empirical studies on reshoring drivers have been conducted in locational contexts such as Germany (Kinkel and Maloca, 2009), Spain (Martínez-Mora and Merino,

2014), Denmark (Arlbjørn and Mikkelsen, 2014), UK (Bailey and De Propris, 2014), USA (Gray et al., 2017) and Finland (Gylling et al., 2015). However, there is limited research on reshoring drivers from Sweden which motivates this research to conduct empirical studies.

Reshoring drivers found in the existing literature

The existing literature has described drivers as factors that "drives firms to make the reshoring decision despite the locational advantage of having low labor costs at the offshoring location." (Wiesmann et al., 2017, p.28). This paper focuses on drivers and distinguishes between 'main driver' and 'sub driver', where the former is built up by the latter (Table 1).

Whereas cost factors drove offshoring, reshoring is mainly driven by quality. Many authors show that 'increase quality' is the most important driver of reshoring (Arlbjørn & Mikkelsen, 2014; Bailey & De Propris, 2014; Bals et al., 2016), in particular, different aspects of quality such as: raw material, product, infrastructure in the home-country, and delivery towards the customer (Lippert & Hutzel, 2014; Martínez-Mora & Merino, 2014; Kinkel & Maloca, 2009). Also, during offshoring, goods were tied up in inventory on ships, a problem which was exacerbated due to slow steaming transportation. As such, reshoring became a way to decrease tied-up capital (Gray et al., 2013; Bailey and De Propris, 2014; Bals et al., 2015).

While there has been an expected cost advantage gained by moving to low-cost countries, scholars have considered different components of cost that have increased in offshored locations such as decreased total costs, control costs, quality control costs, coordination costs regarding quality, product development and staff, decreased differences in labor cost, raw material costs, energy costs, value exchange costs, transportation, decreased inventory and rework costs (Bals et al., 2016; Tate, 2014). Also, drawbacks with offshoring is that it is associated with increased lead-times. Therefore, research has argued that reshoring is driven by decreased lead-times (Arlbjørn & Mikkelsen, 2014; Bailey & De Propris, 2014). Research also shows that reshoring has a significant effect on increased flexibility (Kinkel, 2012) and there is a discussion focusing on flexibility with respect to production and customization (Fratocchi et al., 2016; Gylling et al., 2015).

In recent years, environmental impacts have been a great concern for global supply chains. Therefore, some authors argue that the need to decrease environmental impact drives reshoring. In the same vein, some studies discuss reshoring as a way of decreasing carbon dioxide emissions (Ashby & Hudson-Smith, 2012; Bals et al., 2016; Gray et al., 2013). Bals et al. (2015) discuss that companies want to create synergy effects by reshoring for a competitive advantage. However, recent studies also indicate that increase in innovation ability drives reshoring and different aspects have been identified in the literature such as product and process-development, and the ability to provide product-related services (Lippert & Hutzel, 2014; Pearce, 2014; Tate, 2014).

Many scholars assert that reshoring is a correction mechanism to previous location decisions (Ashby & Hudson-Smith, 2012; Bals et al., 2015; Fratocchi et al., 2016). Moreover, reshoring is driven by the need to protect intellectual assets, which has also been empirically recorded in the literature and brand counterfeiting has been identified as one such problem (Canham & Hamilton, 2013; Fratocchi et al., 2016, Gray et al., 2013). Academics have identified that reshoring is driven by increasing collaboration, which is discussed in two contexts- external collaboration (with stakeholders) and internal collaboration (with departments) (Lippert & Hutzel, 2014; Pearce, 2014; Bailey and De Propris, 2014; Arlbjørn & Mikkelsen, 2014). Some authors argue that reshoring is also driven by access (or proximity) to competence and resources such as qualified personnel, automation and raw material (Bailey, D. & De Propris, L., 2014; Kinkel, 2012; Tate et al., 2014).

Table 1. Reshoring drivers found in the existing literature

Main driver	Sub driver	References (see appendix)
Increase quality	General	[1,3,4,5,6,9,11,12,13,14,15,16,17,18,20,21,22]
	Raw material	[17]
	Product	[4,5,17,18,22]
	Infrastructure	[9,16]
	Delivery	[3,14,16]
Decrease tied-up capital	General	[3,4,5,9,10,12,13,14,15,16,17,18,19,20,21,22]
Decrease total costs	General	[1,3,5,10,12,13,15,16,17,18,19,20,21,22]
	Control	[4,5,10,14]
	Quality control	[14,16]
	Coordination	[3,4,5,10,13,14,15,16,17]
	Quality coordination	[5,14,16]
	Product development coordination	[5]
	Staff coordination	[5,14]
	Labor-cost difference	[1,3,5,6,14,15,17,18,20,22]
	Raw material	[5,16]
	Energy	[5,10,12,22]
	Currency exchange	[3,12,13,17,18,20]
	Transport	[3,10,15,17,18,19,20,22]
	Inventory	[10,18,21]
	Rework	[17]
Decrease lead-time	General	[1,2,3,4,5,6,10,12,13,16,17,18,22]
Increase flexibility	General	[10,13,16,17,22]
	Production	[13,16,17,22]
	Customization	[10,16]
Decrease environmental impact	General	[2,5,12,20]
	Carbon dioxide emissions	[5,12]
Create synergy effects	General	[4]
Increase innovation ability	General	[1,3,5,4,10,16,17,20,21,22]
	Product development	[5,17,21]
	Process development	[17,20]
	Product-related services	[3]
Correct previous location decisions	General	[2,4,10,12,13,16]
Protect intellectual assets	General	[5,6,10,12,16,17,21,22]
	Brand counterfeiting	[10]
Increase collaboration	General	[17,20]
	External collaboration (with stakeholders)	[3,10,20,22]
	Internal collaboration (with R&D)	[1,5]
Access to competence/resources	Qualified personnel	[3,14,16,22]
	Automation	[1,3,5]
	Raw material	[22]
Government subsidies	General	[3,5,22]
Branding (Made in 'X')	General	[5,6,10,17,18,22,20]
Mitigate risks in the host-country	General	[3,4,5,10,12,16,20]
	Supply chain disruptions	[3,4,5,8,10,14,18,19,20,22]
	Political uncertainties	[8]
	Environmental issues	[8]
	Regulations	[8]
	Currency fluctuation	[10,22,23]
Increase capacity utilization	General	[5,14]
Increase control	General	[4,5,14,16,18,20]
	Supply chain control	[4]
	Production control	[16,20]
Change in company's strategy	General	[4]
Overcome geographical and cultural barriers	General	[20]
	Time-zone difference	[17]
	Cultural barriers	[5,12,14, 16, 17, 20]
	Language barriers	[4,10,12,20]
Employee loyalty	General	[6,14,16]
Patriotism	General	[2,6,17]
	Create jobs in home country	[6]
	Preserve/develop skills in homeland	[2]

Moreover, some authors discuss the role of governmental subsidies in reshoring, as policy-makers compensate companies with tax-cuts for bringing back production to the homeland (Bailey & De Propris, 2014; Bals et al., 2016; Tate et al., 2014). Some authors discuss 'made-in' branding as a marketing strategy (Bals et al., 2016; Canham & Hamilton, 2013; Lippert & Hutzel, 2014). However, other authors argue that companies reshore in order to mitigate different risks within the host-country such as supply-chain disruptions, political uncertainties, environmental issues, regulations and currency fluctuation (Ellram et al., 2013). According to Kinkel (2012), through reshoring, companies wish to increase capacity utilization.

Other benefits of reshoring are increased control over the supply chain and production (Bals et al., 2015; Kinkel & Maloca, 2009; Pearce, 2014). According to Bals et al. (2015), for some companies, reshoring is driven by change in the company's strategy. Moreover, many authors confirm that distance and cultures hinder businesses, therefore, reshoring is a suggested remedy. However, some articles consider differences such as time-zone difference, cultural and language barriers (Bals et al., 2016; Lippert & Hutzel, 2014). Some authors argue the role of intangible assets in reshoring such as employee loyalty is achieved by employing national citizens and have looked at patriotism as a driver, to save jobs in the home country and, preserve and develop skills in the homeland (Canham & Hamilton, 2013).

Research methodology

The case study research strategy was considered the most appropriate one since reshoring is a relatively unexplored research area (Fratocchi et al., 2014). A case study provides a way to develop new theory and test previously developed theory. It investigates a phenomenon in-depth, within a real-life context, in order to gain a richer understanding of the phenomenon (Edmondson & McManus, 2007; Eriksson, 2015; Yin, 2009). It is also suitable to employ a case study strategy when using 'what' and 'how' research questions (Benbasat et al., 1987).

A multiple case study was used, including three companies from the Swedish manufacturing industry. This allows for cross-case analysis, comparison and investigation of a particular phenomenon in diverse settings (Yin, 2009). The included case companies were selected based on their previous offshoring and reshoring experience. This type of selection is beneficial when seeking knowledge within a specific area (Yin, 2009). Three case companies (called Alpha, Beta and Gamma) were selected in order to capture a wider spectrum of knowledge and experience in the targeted area. All of them are located in Sweden. The case companies are from manufacturing sector and serve a global market. They have some differentiating traits, for example, they operate in different industries, and have different turnover, number of employees and ownership structure.

The main data collection was semi-structured interviews, and it was complemented with meetings, workshops and observations. To improve the quality of the collected data, voice recordings were used together with note-taking. The companies' different sizes affected the number of people involved in offshoring and reshoring decisions. Thus, the number of conducted interviews at each company varied. In total, eight interviews were conducted with a total of 13 respondents. The collected data was analyzed using both within case analysis and cross case analysis. A qualitative content analysis was conducted using a three-step process: data reduction, data display and conclusion drawing (Miles & Huberman, 1994).

Findings

Alpha is a family-owned manufacturer, with production located in Sweden and China. The company has around 50 employees in Sweden and had a revenue of 3.5 million euros in 2016. In Alpha, 21 sub drivers from 14 main drivers were identified (Table 2).

Table 2. Reshoring drivers found in Alpha

Main driver	Sub driver	Supporting quote
Increase quality	General	"Sweden has good infrastructure, power supply, as well as other factors that we take for granted" (General manager)
	Infrastructure	
Decrease total costs	General	"We wish to receive a lower total cost" (General manager)
	Energy	Sweden has good infrastructure, power supply, as well as other factors that we take for granted" (General manager)
	Quality coordination	"When offshoring, it is easy to miss that in case of quality problems, staff/ technicians might have to be sent to solve the problems. This has to be considered and budgeted, but it is rarely done" (General manager)
	Raw material	"It is possible to decrease the cost for material" (General manager)
Decrease lead time	General	"For some customers, the lead time is so important that they want production in Sweden exclusively" (General manager)
Increase flexibility	Production	"We want to increase the batch-size flexibility. Thanks to short lead times it is possible to increase or decrease the batch size according to the customer's needs" (General manager)
Decrease environmental impact	General	"The customer wants products that are environmentally well produced" (General Manager)
Increase innovation ability	Product-related services	"We wish to keep production in Sweden, and by doing so add value for our customers, we can sell security" (General manager)
Correct previous location decisions	General	"Companies have forgot to calculate and buffer for all risks which may appear" (General manager)
Increase collaboration	External collaboration	"By being close, it is easier to have good relations with the customer, we know and understand what the customer wants" (General manager)
Branding	General	"Made in Sweden is good branding, not top of the line, but pretty good" (General manager)
Mitigate risks in the host-country	Supply chain disruptions	"We want to eliminate risks with long transportation times, for when things have gone wrong." (General manager)
	In-transit damages	"Avoid damages from handling the goods, fewer moves and handlers can decrease the risk of damaged products" (General manager)
Increase control	Production control	"We want to gain increased control over the production and the changes one wishes to do. Complex products are easier to supervise if the production is close" (General manager)
	Product	"They [customers] want to have the last control so that functions, finish and everything like that is in place" (General manager)
Overcome geographical and cultural barriers	Language barriers	"It is not easy to specify quality, but having the same basic language, Swedish, makes it a lot easier" (General manager)
	Cultural barriers	"When you order a product in Sweden, you decide how it is to be produced, both agree, then you start to produce. It is not so much fuss and hassle. In China, there are a lot of hassle, among other things with payment agreements" (General manager)
Employee loyalty	General	"Swedish workers are more loyal compared the Chinese workers who often quit after the Chinese New Year" (General manager)
Patriotism	Preserve/develop skills in homeland	"We want to protect the competence and maintain it in Sweden" (General manager)

Beta is a conglomerate manufacturer with production in Sweden, Norway and the Netherlands. The company has around 150 employees in Sweden and had a revenue of 50 million euros in 2016. In Beta, 23 sub drivers from 11 main drivers were identified (Table 3).

Table 3. Reshoring drivers found in Beta

Main driver	Sub driver	Supporting quote
Increase quality	Delivery	"Secure deliveries to the customer" (Vice president, production)
Decrease total cost	General	"To find some type of saving" (Manager, supply chain management), "Can we become more cost effective?" (Vice president, production)
	Quality control	"If we have a quality problem [from supplier] we need to fix it fast. Should our supplier come to us and fix it, or should we send the products back?" (Manager, supply chain management)
	Staff coordination	"We want to avoid a lot of travelling since it is expensive and take a lot of time." (Vice president, production)
	Labor-cost difference	"Wages are changing in Lithuania, the difference in labor cost is decreasing" (Vice president, production)
	Energy	"Reassure stable processes by having a good power supply" (Manager, supply chain manager)
	Production stop	"Costs for starting production that had to be stopped could be reduced if we had the production at home instead" (Vice president, production)
Decrease lead-time	General	"By having it [production] at home you get shorter lead-times" (Production development)
	Order handling	"You get shorter delivery times, shorter order-to-delivery and so on" (Quality manager)
	Manufacturing	"If we can decrease the [internal] lead-time, we can also lower our lead-time towards our customer" (Manager, supply chain management)
Increase flexibility	Production	"If you have variations on what you previously offshored, then you're increasing your flexibility when you reshore" (Quality manager)
	Labor competence	"Flexibility in competence can be challenging when the fixed workforce is not so great. If we had larger quantities, we could have more permanent staff, thus higher flexibility in competence" (Vice president, production)
Create synergy effects	General	"Increase the proportion of products manufactured in Sweden, to get synergy effects" (Vice president, production)
	Spread overhead costs	"To have more products that can carry the overhead, which results in lower cost per product" (Production development)
Correct previous location decisions	General	"Previous offshoring decisions have not always been rational" (Production development)
Increase collaboration	External collaboration	"When customizing a lot, it's beneficial to have production close to the customer." (Production development)
Increase control	Production control	"For late annuals, it is difficult to stop an already started process" (Vice president, production)
	Product	"Decrease risks by having control over the products ourselves" (Manager, supply chain management)
Increase innovation ability	Product-related services	"The market has changed and today requires more personalized products. Companies do not want to buy 100 black chairs anymore, instead they ask their employees what they want" (Vice president, production)
Overcome geographical and cultural barriers	General	If you have problems [with quality] it's easier to handle them when you have it close and can go out and look at the problems. Compare that to explaining via email and photos" (Quality manager)
	Language barriers	"To increase customer benefits such as easier communication, problem free contracts and kept promises." (Vice president, production)
	Cultural barriers	
Patriotism	Create jobs in home country	"We feel a responsibility towards the society and wants to employ people in the region we work" (Production development)

Gamma is owned by a multinational corporation and has production placed in Sweden, Spain, Japan, China and the US. The company has around 400 employees in Sweden and had a revenue of around 130 million euros in 2016. In Gamma, 29 sub drivers from 14 main drivers were identified (Table 4).

Table 4. Reshoring drivers found in Gamma

Main driver	Sub driver	Supporting quote
Increase quality	General	"It's always easier to have quality control close to yourself" (Controller, products)
	Product	"By having the production in-house better quality of the product can be held" (Manager, manufacturing engineering)
	Delivery	"It may be that you have major delivery issues" (Manager, supplier quality)
Decreased total cost	Transport	"Logistics costs, it is becoming more and more expensive to ship things through Europe" (Vice president, manufacturing)
	Quality coordination	"One thinks that a printing is black and white, with different symbols. But the problem is that then you have different symbols and different standards and different things, so it becomes difficult" (Manager, quality engineering)
	Inventory	"We are good at compensating for [supply chain] problems and instead build a lot of inventory" (Controller, products)
	Raw material	"The supplier comes with high price increases" (Manager, supplier quality)
	Rework	"If you have quality issues on a shipment [from China], it will take 6 months before you get it corrected" (Controller, products)
	Production stop	"A stop in one of the lines costs 10,000 euros a day. Is it worth having that risk, just so we can buy a little bit cheaper from China?" (Vice president, manufacturing)
Decrease lead-time	General	"Before the company's first reshoring occurred, we had problems with lead-times" (Vice president, manufacturing)
Create synergy effects	General	"If it is possible to produce at the same price, then you reshore your production to get economies of scale" (Controller, products)
	Spread overhead costs	"If we can spread the over-head cost on more products, then we can afford to invest in equipment" (Vice president, manufacturing)
Increase innovation ability	Product development	"If you have the product internally, you can easier see opportunities to make rationalizations [improvements], change materials, make it simpler, cheaper or better" (Industrial engineer)
	Process development	"Having research and development close to the product is beneficial for process development, to maintain knowledge and activity, that it works together" (Industrial engineer)
Access to competence/resources	Raw material	"We were a small customer and got to be down-prioritized in case of problems with their supplier. We could basically only buy steel if there were any left-overs" (Controller, products).
Change in strategy	General	"Strategic decision, they said, it should be done here, adjust it so it works" (Industrial engineer)
Increase collaboration	Internal collaboration	The management wants to nail the company down in the ground, strengthen it towards our sister factory, so they want us to do as much as possible here. Closing this factory should be tough" (Industrial Engineer)
Protect intellectual assets	Brand counterfeiting	"In China, nor patent or design protection is respected. We have been told that we can send an engine from Germany, so they can copy it [and sell to us], no problem they think" (Vice president, manufacturing)
Mitigate risks in the host-country	Supply chain disruptions	"Avoid delivery issues. Storms on the Baltic sea can stop deliveries from Estonia" (Vice president, manufacturing)
	Terrorism	"I will never ask my colleague to go down and help start up a production if it is stopped because of a terrorist attack" (Manager, quality engineering)
Increase capacity utilization	General	"We have the available capacity, for example in a welding robot, which is an expensive investment. There is possibility to fill up the capacity with further details" (Manager, supplier quality)
Increase control	General	"Increased control also provides with many other benefits." (Manager, supplier quality)
	Supply chain control	"It's not just the supplier's fault, it's others involved as customs, carriers, yes everything can happen" (Manager, supplier quality)
	Product	"You want to get back control of the product" (Strategic buyer)
Overcome geographical and cultural barriers	Language barriers	"I participated in a bad telephone conference with Chinese subcontractors, they only spoke Chinese, so it was interpreted from Chinese to Japanese, then from Japanese to English. Then we held the meeting in English, but our own language is Swedish. It will not be right. Add bad telephone connection and late or early in the day" (Manager, quality engineering)
	Time-zone difference	
	Communication disruption	
	Cultural barriers	"Cultural differences, does a 'yes' mean 'yes', and what does 'we'll look at it' mean?" (Vice president, manufacturing)
Patriotism	Create jobs in home country	"If you outsource/ offshore, someone needs to lose their job." (Vice president, manufacturing)

Discussion

The reshoring drivers found in the case study, in comparison to the literature, are presented in Table 5. In total 49 unique sub drivers, combined into 20 main drivers, were found in the case study. 40 of the found sub drivers were also identified in the literature while 9 were new ones. Of the sub drivers found in the literature, 21 were not found in the case study. All, except one, main drivers were found in both the case study and the existing literature. The main driver 'government subsidies' was found only in the literature. The literature represents a much broader empirical setting than this study which covers three companies from the Swedish manufacturing industry. Moreover, it is very interesting to note that our small empirical setting revealed 9 additional sub drivers.

In the case study, the highest and the lowest number of sub drivers were found in Gamma and Alpha respectively. This is perhaps not surprising, as Gamma is a larger company with more dedicated resources. This finding could imply that the larger companies seem to consider more reshoring drivers than smaller ones.

Table 5. Reshoring drivers found in the case study and literature review

Main driver	Sub driver	Alpha	Beta	Gamma	Lit.
Increase quality	General	X		X	X
	Raw material				X
	Product			X	X
	Infrastructure	X			X
	Delivery		X	X	X
Decrease tied-up capital	General				X
Decrease total cost	General	X	X		X
	Control				X
	Quality control		X		X
	Coordination				X
	Quality coordination	X		X	X
	Product development coordination				X
	Staff coordination		X		X
	Labor-cost difference		X		X
	Raw material	X		X	X
	Energy	X	X		X
	Currency exchange				X
	Transport			X	X
	Inventory			X	X
	Rework			X	X
	Production stop		X	X	
Decrease lead-time	General	X	X	X	X
	Order handling		X		
	Manufacturing		X		
Increase flexibility	General				X
	Production	X	X		X
	Customization				X
	Labor competence		X		
Decrease environmental impact	General	X			X
	Carbon dioxide emissions				X
Create synergy effects	General		X	X	X
	Spread overhead costs		X	X	
Increase innovation ability	General				X
	Product development			X	X
	Process development			X	X
	Product-related services	X	X		X
Correct previous decisions	General	X	X		X
Protect intellectual assets	General				X
	Brand counterfeiting			X	X

Increase collaboration	General				X
	External collaboration	X	X		X
	Internal collaboration			X	X
Access to competence/resources	Qualified personnel				X
	Automation				X
	Raw material			X	X
Government subsidies	General				X
Branding (Made in 'X')	General	X			X
Mitigate risks in the host-country	General				X
	Supply chain disruptions	X		X	X
	Political uncertainties				X
	Environmental issues				X
	Regulations				X
	Currency fluctuation				X
	In-transit damages	X			
	Terrorism			X	
Increase capacity utilization	General			X	X
Increase control	General			X	X
	Supply chain control			X	X
	Production control	X	X		X
	Product	X	X	X	
Change in company's strategy	General			X	X
Overcome geographical and cultural barriers	General		X		X
	Time-zone difference			X	X
	Cultural barriers	X	X	X	X
	Language barriers	X	X	X	X
	Communication network disruptions			X	
Employee loyalty	General	X			X
Patriotism	General				X
	Create jobs in home country		X	X	X
	Preserve/develop skills in homeland	X			X

The main driver ‘government subsidies’ was not found in any of the cases. This suggests that policy-makers in Sweden have not yet drawn companies’ attention in encouraging manufacturing reshoring. The case study also revealed new sub drivers, which were not found in the existing literature such as decreased cost of production stop, decreased order-handling and manufacturing lead-times, increased flexibility in labor competence, create synergy effects by spreading overhead costs, mitigate risks of in-transit damages in host country, mitigate risks of terrorism in host country, increase control over product and overcome barriers of communication network disruptions.

Conclusion

The topic of reshoring is relatively new and unexplored. This article fulfills the purpose of investigating the contextual nature of reshoring drivers. The purpose was guided by two research questions. The first question was: ‘What are the reshoring drivers in a Swedish manufacturing context?’. The study identified 49 sub drivers within the Swedish manufacturing industry, which were grouped into 20 main drivers. The second research question was: ‘How do the reshoring drivers from the Swedish manufacturing industry differ from those in the existing literature?’. The study revealed that 40 sub drivers were found in the literature while 9 were new. All main drivers except ‘government subsidies’ were found in both the case study and the existing literature. This leads the research to propose the following:

Proposition 1: Reshoring drivers are context dependent.
Proposition 2: The number of drivers considered by a firm correlates positively with firm size.
Proposition 3: Government subsidies is not a significant driver for reshoring in Sweden.

In future research, it is necessary to find more empirical evidence of reshoring in order to strongly support these propositions. Moreover, it is interesting to incorporate the drivers into a decisions model, to help managers to make correct and rational location decisions.

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Appendix A

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Managing outsourced new product development: The role of organizational controls, knowledge integration mechanisms, and supplier flexibility

Vikrant Sihag (Corresponding Author)
Rotterdam School of Management, Erasmus University
Department of Technology and Operations Management
P.O.Box 1738, 3000 DR, Rotterdam, the Netherlands
Phone number: +31 10 408 9784
Email: sihag@rsm.nl

Serge A. Rijsdijk
Rotterdam School of Management, Erasmus University
Department of Technology and Operations Management
P.O.Box 1738, 3000 DR, Rotterdam, the Netherlands
Email: srijsdijk@rsm.nl

Jan van den Ende
Rotterdam School of Management, Erasmus University
Department of Technology and Operations Management
P.O.Box 1738, 3000 DR, Rotterdam, the Netherlands
Email: jende@rsm.nl

ABSTRACT
Managing outsourced new product development (NPD) activities is a core issue for clients. Clients depend on supplier flexibility since NPD always takes place in a context of uncertainty, and being able to quickly respond to changes in the demands of clients, is essential for performance. In this study, we investigate the influence of organizational controls (outcome, behavior, clan) and knowledge integration mechanisms (KIMs) on supplier flexibility, and its effect on NPD project performance. Using data from 109 projects involving NPD outsourcing, this study reveals that outcome and clan controls enhance supplier flexibility, but behavior control and KIMs do not. Post hoc analyses suggest that supplier flexibility mediates the effectiveness of outcome and clan controls with outcome control acting as a double-edged sword.

Keywords:
knowledge integration mechanisms, new product development, organizational controls, outsourcing, supplier flexibility

Paper Category: Competitive Paper (Paper 152)

INTRODUCTION

Organizations outsource their new product development (NPD) activities to gain competitive advantage. Outsourcing helps organizations to complement their core capabilities with supplier's unique knowledge, skills, and resources (Carson, 2007; Stanko and Calantone, 2011). Access to such complementary and specialized knowledge and resources in NPD projects has been found to have a positive influence on a wide range of performance outcomes, including shorter development times, improved product quality, and lower development costs (Takeishi, 2001).

Despite the competitive advantages offered by NPD outsourcing, many organizations face challenges in effectively managing outsourced NPD activities, in particular, due to the evolving nature of NPD projects (Stanko and Calantone, 2011). NPD activities evolve over the course of a project because of various reasons, such as change in market dynamics, acquisition of new technical and product knowledge, and creation of new knowledge due to project learning (Tatikonda and Rosenthal, 2000). Therefore, the product specifications generally change in the midst of a NPD project. As a consequence, the initial agreed project requirements between clients (organizations that outsource the activities) and suppliers (organizations to whom the activities are outsourced) may no longer be adequate (Ivens, 2005; Noordewier, John, and Nevin, 1990). To cope with this problem, clients want their suppliers to incorporate the new requirements (Ivens, 2005; Narayanan and Narasimhan, 2014). Therefore, clients depend on supplier flexibility, which is the willingness of suppliers to behave in a flexible manner to the changing requirements of clients (Cannon and Homburg, 2001; Ivens, 2005).

Although clients benefit from supplier flexibility, it entails considerable costs for suppliers as they have to ensure increased availability of various resources for making adjustments (Han et al., 2014). A lack of flexibility on a supplier's part can result in problems such as developing a product that does not meet client's requirements and that can lead to lower project performance. To facilitate flexible behavior from suppliers, clients need to ensure that its suppliers are willing to align their efforts to incorporate the new requirements (Gulati, Lawrence, and Puranam, 2005; Ivens, 2005). Achieving alignment of efforts from suppliers requires both cooperation (alignment of interests) and coordination (alignment of actions) from them (Gulati et al., 2005). Therefore, clients need to know the mechanisms that they can exercise to facilitate cooperation and coordination to foster supplier flexibility.

In addition, most of the research on supplier flexibility that entails responsive behavior perspective has focused on those determinants (opportunism, market uncertainty, relationship-specific investments, and mutuality) of flexibility that do not focus on cooperation and coordination aspect of inter-organizational relationships (e.g., Han et al., 2014; Ivens, 2005). Further, this research has mostly focused on relational outcomes such as buyer satisfaction, relationship commitment, relationship quality, and trust either in industrial buyer-supplier or in channel relationships. Thus, the role of supplier flexibility in NPD outsourcing remains poorly understood.

Several previous studies have identified organizational controls and knowledge integration mechanisms (KIMs) as the mechanisms that enable cooperation and coordination respectively (e.g., Luca and Atuahene-Gima 2007; Tiwana and Keil 2009). Clients can exercise organizational controls to increase cooperation from suppliers as controls motivate suppliers to align their interests with client's interests (Das and Teng, 1998). Similarly, KIMs can help clients to improve the efficacy of their coordination efforts through effective transfer of knowledge between them and suppliers (Luca and Atuahene-Gima, 2007). Therefore, this research examines the influence of organizational controls and KIMs on supplier flexibility. In addition, increased supplier

flexibility can help clients to achieve the desired NPD project objectives in a timely manner as they can efficiently use supplier resources to respond to the changes in project requirements (Cannon and Homburg, 2001). Hence, greater supplier flexibility plays a critical role in the success of NPD projects. As such, this study investigates the relationship between supplier flexibility and NPD project performance. This research therefore aims to study the following research questions: (1) Do organizational controls and KIMs enhance supplier flexibility?, and (2) Do supplier flexibility influence the NPD project performance?

Investigation of these research questions provides fresh insights that make several contributions to the existing literature. First, by investigating the influence of controls and KIMs on supplier flexibility, clients can ascertain how to facilitate flexible behavior from its suppliers and deal with requirements that emerge over the lifecycle of a NPD project. This is important to investigate in NPD projects since these projects are inherently knowledge-intensive and involve a high degree of ambiguity and therefore organizations generally require more cooperation and coordination from their suppliers than that is required in other type of projects (Yan and Dooley, 2013). Therefore, this study contributes to NPD outsourcing literature. Understanding the mechanisms that can facilitate supplier flexibility can also contribute to effective management of relationships between buyers and suppliers in a supply chain. Second, a lack of supplier flexibility can lead to delivery of a product that does not meet the client's expectations and that can result in lower NPD project performance. By exploring supplier flexibility's influence on NPD projects, scholars can also better understand the effectiveness of organizational controls and KIMs in managing outsourced NPD activities. Further, most of the existing research on the effectiveness of organizational controls and KIMs has been limited to in-house NPD projects even though organizations quite often outsource their NPD activities (e.g., Bonner, Ruekert, and Walker, 2002; Luca and Atuahene-Gima, 2007). Therefore, this research also contributes to the literatures on the effectiveness of organizational controls and KIMs. Overall, our research provides new insights to practitioners as well as scholars and help them to better understand the various managerial mechanisms that can be exercised in complex projects encompassing development activities that span organizational boundaries.

THEORETICAL BACKGROUND

Cooperation, coordination, and supplier flexibility

Clients need to manage both cooperation and coordination problems with their suppliers to foster supplier flexibility. The problem of cooperation arises as a result of conflicts of interests between clients and suppliers (Gulati et al., 2005). Though clients outsource their development activities to suppliers due to the fact that they are not alike and have divergent skills or interests, such differences also provide sufficient grounds for conflicts of interest (Das and Teng, 2001; Johansson, Axelson, Enberg, and Tell, 2011). Due to divergent objectives, suppliers are more likely to behave in ways that favor their own interests ahead of clients' interests (Wallenburg and Schäffler, 2014) and therefore they are less likely to act flexibly. The problem of coordination occur due to inadequate shared and accurate knowledge between client and its suppliers (Gulati et al., 2005; Johansson et al., 2011). The difference in knowledge domain along with the organizational boundary between clients and its suppliers makes it difficult for them to share the accurate knowledge that is embodied in their employees and routines (Johansson et al., 2011; Puranam and Gulati, 2008). Due to lack of shared and accurate knowledge, both clients and suppliers do not fully understand each other's decision rules and how their actions are interlinked with one another (Gulati et al., 2005). Therefore, clients face difficulty in coordinating their actions

with its suppliers and making effective decisions to deal with evolving requirements. The problems of cooperation and coordination are rooted in different paradigms and clients therefore need to exercise different mechanisms to resolve both these problems. While cooperation problems arise due to divergent interests between clients and suppliers, coordination problems are caused due to poor knowledge transfer between them (Gulati et al., 2005; Yan and Dooley, 2013). Therefore, clients need to exercise mechanisms that align suppliers' interests with their interests to deal with cooperation problems, whereas they need to use mechanisms that enable knowledge transfer with suppliers to address cooperation problems.

HYPOTHESES DEVELOPMENT

Organizational controls and supplier flexibility

Organizational controls help clients to manage cooperation problems between them and suppliers as controls facilitate alignment of interests (Das and Teng, 2001). Organizational controls refer to the mechanisms used by controllers (in this case, the clients) to motivate controllees (in this case, the suppliers) to behave in a manner that is consistent with controllers' objectives (Tiwana, 2008; Turner and Makhija, 2006). Although control scholars have identified several types of organizational controls, we focus on the three most investigated organizational controls that are conceptually well elaborated in the literature: outcome, behavior, and clan (Cardinal, Kreutzer, and Miller, 2017). In this study, we postulate that a client's use of outcome, behavior, and clan controls resolve the cooperation problems with its suppliers to enhance supplier flexibility. We first discuss outcome control.

Outcome control involves controllers specifying desired quantitative performance goals evaluating controllees' performance based on the extent to which they have achieved the specified goals (Cardinal, 2001; Turner and Makhija, 2006). In the in-house NPD projects, controllers, that is, project managers generally specify performance outcomes such as project budget, cycle time, project goals, and deliverables to controllees, that is, project team members (Bonner et al., 2002). Such performance outcomes can also be specified by clients to its suppliers and therefore can be used by clients to evaluate suppliers' performance against the specified outcomes. The outcomes used by clients for development activities that span organizational boundaries are generally derived from the goals that determine the overall project performance (Gopal and Gosain, 2010; Tiwana and Keil, 2009). As a result, outcome control aligns the suppliers' goals with those of clients. According to Chen et al. (1998), one actor cooperates with another actor when their goals are positively related to each other. As such, outcome control motivates suppliers to behave more cooperatively. Therefore, suppliers are more likely to show cooperative behaviors such as responding flexibly to clients' needs as goals are associated with the motives that underlie the intended behavior (Yan and Dooley, 2013). Outcome control therefore ensures that suppliers identify with a client's requirements and respond in a manner that is in alignment with the client's requirements.

Outcome control also facilitates cooperative behavior from suppliers due to its hands off approach and that further enhances supplier flexibility. Outcome control follows a hand-off approach since it does not specify the type of process that needs to be followed for achievement of specified goals (Turner and Makhija, 2006). Once a client specifies the desired outcomes, suppliers are given substantial autonomy and independence to select and follow their own procedures for achievement of the specified outcomes (Wallenburg and Schäffler, 2014). Because of the autonomy and independence afforded by outcome control, suppliers can efficiently deal with emerging project requirements and therefore they are more likely to accommodate new

requirements from the client. Moreover, the hands-off approach of outcome control is perceived by suppliers as less obtrusive and therefore arouse less psychological reactance in them (Anderson and Oliver, 1987). Also, the use of outcome controls is perceived by suppliers as a signal that its client consider it more trustworthy and competent because outcome control does not involve close monitoring of suppliers' behaviors (Atuahene-Gima and Li, 2006; Wallenburg and Schäffler, 2014). Suppliers are therefore less likely to indulge in opportunistic behaviors. Low levels of opportunism has been shown to be associated with high levels of supplier flexibility (Han et al., 2014). Therefore, outcome control discourages opportunism and encourages flexible behavior from suppliers. Consequently, we expect outcome control to enhance supplier flexibility. Thus, we propose that:

H1: Outcome control is positively associated with supplier flexibility.

Behavior control involves controllers emphasizing procedures and rules that controllees need to follow while doing their assigned activities and evaluate controllees on the basis of their adherence to the prescribed procedures (Bonner et al., 2002; Tiwana and Keil, 2009). Behavior controls in a NPD context can include specifying development methodology, rules, and procedures (Cooper, 2001; Tatikonda and Rosenthal, 2000). Scholars and practitioners have posited that prescribing specific development methodology and procedures such as stage-gate process, quality function deployment, and design for six sigma, which are analogous to behavior controls, help in alignment of different functional perspectives and interests, and that leads to completion of development activities (e.g., Cooper, 2001, 2008). We therefore extend this reasoning to the NPD outsourcing context and expect similar effect of behavior control in facilitating cooperative behaviors between clients and suppliers. In particular, the use of standard development methodology and procedures provide a structure and flow to the development activities (Tatikonda and Rosenthal, 2000). Such a structured environment helps suppliers to better understand their role in a NPD project and the procedures that client's employ to evaluate the suppliers' performance (Aulakh and Gencturk, 2000; Carbonell and Rodriguez-Escudero, 2013). Therefore, the transparent nature of behavior control reinforces suppliers' beliefs of their integral role in the project and the perception of being treated fairly. Consequently, suppliers are more likely to take ownership of clients' interests and engage in cooperative behaviors by being flexible in allowing adjustments in project requirements.

Behavior control also requires dynamic involvement of clients as they need to actively provide inputs related to behaviors that suppliers need to follow for completion of various project activities. Such an active involvement from client signals to supplier that the client is committed to the project (Aulakh and Gencturk, 2000). The active involvement of clients in supplier's development activities also allows clients to deepen their understanding of various issues related to a project (Choudhury and Sabherwal, 2003). The gained knowledge helps clients to not only provide feedback to suppliers for corrective actions, but also helps them to make decisions regarding trade-offs that can be made to deal with changes in project requirements (Liu, 2015). As such, behavior control helps suppliers to better deal with uncertain requirements as this control allows clients to resolve various issues faced by suppliers in a timely manner (Gopal and Gosain, 2010). Thus, behavior controls are less likely to be perceived by suppliers as imposed without any understanding and foster suppliers' cooperativeness. Therefore, behavior control increases the efficacy of supplier in dealing with ambiguous and complex situations, and, in turn, engender flexibility of suppliers to accept changes in project requirements

In contrast, some scholars have argued that imposing standard development methodology and procedures constraints suppliers from using their own idiosyncratic expertise (e.g., Bonner et al., 2002; Tiwana and Keil, 2007). As noted earlier, NPD project requirements evolve over the course of the project and suppliers need their creativity and independence for quickly responding to such emerging problems (Carson, 2007). Thus, constraining their discretion to adjust the development procedures may foster inertia in suppliers and increases the likelihood that the suppliers will be less willing to readily accept the changes desired by clients (Tiwana and Keil, 2007). A client's use of standard procedures can also be perceived by its supplier as a signal that the client does not believe that the supplier can complete the outsourced development activities without its directions. Further, monitoring in behavior control can send a negative signal to a supplier that its client does not trust the supplier completely (Tiwana, 2010; Wallenburg and Schäffler, 2014). Therefore, client's use of behavior control can result in supplier feeling circumscribed and that can result in suppliers not willing to accept client's request for changes in project requirements. In summary, the aforementioned arguments suggest that behavior control can either facilitate or diminish supplier flexibility. Therefore, the following two competing hypotheses:

H2a: Behavior control is positively associated with supplier flexibility.

H2b: Behavior control is negatively associated with supplier flexibility.

In clan control, controllers employ mechanisms to motivate controllees to embrace common values, norms, and goals, and to behave in a manner that is in line with agreed-upon behaviors (Kirsch et al., 2010; Ouchi, 1979). Examples of such mechanisms in client-supplier relationships include social events, off-site meetings, and casual lunch or dinner. These socialization mechanisms facilitate transmission of beliefs, values, and cultural norms between clients and suppliers and thereby increase suppliers' cooperativeness in achievement of clients' interests (Choudhury and Sabherwal, 2003). In other words, clan control facilitate internalization of values and norms between client and suppliers making them more dedicated and committed to achievement of project objectives (Das and Teng, 2001). As such, the internalization of values and norms by suppliers enables them to respond flexibly to new requirements that emerge in the midst of the project, because the values and norms are clear to them (i.e., achievement of project objectives), even though the situation is new (Lebas and Weigenstein, 1986). Further, clan controls increase flexibility because social interactions enable parties to mutually adapt and make adjustments quickly under conditions of evolving requirements (Rijsdijk and van den Ende, 2011).

Clan control also foster generation of common understanding and language between clients and suppliers (Choudhury and Sabherwal, 2003; Tiwana, 2010). The development of common understanding and language further enhance cooperative behavior from suppliers as it provides a rich and broad implicit guide to suppliers as what is considered as an acceptable or deviant behavior by the clients without formally monitoring their compliance to acceptable behaviors (Aulakh and Gencturk, 2000; Kirsch et al., 2010). As a result, suppliers are intrinsically motivated and are committed to achievement of project objectives (Das and Teng, 2001). As suppliers are committed to project objectives, they are more likely to be willing to respond flexibly to client's requirements. As such, clan control help realizing flexible behaviors from suppliers through cooperation. Clan control also promotes mutual trust and interests through informal social interactions (Das and Teng, 1998). The increase in positive mutual expectations and interests motivates suppliers to commit to their partnerships with clients (Das and Teng, 2001). This encourages suppliers to openly identify issues and share and discuss them with clients (Gopal and

Gosain, 2010). Thus, clan control further promote cooperative behavior from supplier to respond flexibly as NPD issues are more likely to be identified, examined and resolved. Past research has also shown that mutual trust and interests between clients and suppliers lead to improved decision making and on time completion of NPD activities (e.g., Bstieler, 2006). All in all, clan control plays a pivotal role in promoting supplier flexibility by enabling cooperative behaviors from suppliers. We therefore hypothesize that:

H3: Clan control is positively associated with supplier flexibility.

KIMs and supplier flexibility

The coordination problems can be resolved by using KIMs as they facilitate knowledge transfer (Gulati et al., 2005; Luca and Atuahene-Gima, 2007). KIMs help different parties to synthesize, analyze, reconfigure and integrate different types of knowledge among them (Luca and Atuahene-Gima, 2007). Specifically, KIMs are processes and structures, such as systematic information-sharing meetings, analysis of successful and failed projects, project reviews that enable one party to capture, articulate, combine and exploit the varied knowledge and skills of other parties (Luca and Atuahene-Gima, 2007). We posit that KIMs play a pivotal role in effective coordination between clients and suppliers as they enable transfer of knowledge between them, and therefore enhance the flexibility of supplier to accept new requirements that emerge during the project.

As NPD projects are faced with new emerging requirements, the new requirements needs to be integrated into the development process for completion of development activities (Tatikonda and Rosenthal, 2000). KIMs facilitate integration of new requirements into the development activities as they allow both clients and suppliers to make better sense of emerging requirements because KIMs involve use of information processing mechanisms, such as face-to-face meetings, success and failure analysis, and project reviews, (Luca and Atuahene-Gima, 2007; Takeishi, 2001). As a result, clients and their suppliers are more likely to make timely decision related to trade-offs that can be made with regards to integration of new requirements in the development activities. Therefore, suppliers are more likely to be flexible in aligning their actions for integrating new requirements into the development activities.

NPD projects also involve transfer of both codified and tacit knowledge for effective coordination and completion of development activities. While codified knowledge can be easily articulated and transferred, tacit knowledge is not easily transferable or codifiable as it is sticky in nature and requires close observations and interactions (Johansson et al., 2011). As such, the transfer of tacit knowledge affects client's ability to coordinate the development activities and supplier's ability to responding flexibly as they don't understand the interdependencies among various development activities. KIMs facilitate transmission of tacit knowledge as they enable different parties to work together closely and exchange knowledge with each other (Luca and Atuahene-Gima, 2007). Suppliers are therefore better able to understand how client's development activities are interdependent on their development activities and this encourage suppliers to take the actions that are necessary for fulfillment of client's new requirements. Thus, the use of KIMs facilitate better coordination between clients and suppliers, and promotes supplier flexibility.

KIMs allow different parties to openly discuss the various approaches that could be followed to solve various development problems that emerge throughout the entire NPD project. They also provide common platform for one party to give feedback to another party and analyze various project problems and mistakes (Luca and Atuahene-Gima, 2007). In other words, KIMs enable involved parties to learn from past product development activities and effectively exploit the learned knowledge for carrying out the future product development activities (Luca and

Atuahene-Gima, 2007). Therefore, clients' use of KIM will enhance coordinative and flexible behaviors from suppliers because problems can be openly identified, examined, and resolved. In summary, we expect KIMs to enhance supplier flexibility. Therefore, we hypothesize that:

H4: KIMs are positively associated with supplier flexibility.

Supplier flexibility and NPD project performance

Supplier flexibility emphasizes the willingness of supplier to accommodate changes in the client's requirements (Ivens, 2005). Having a greater supplier flexibility suggests that a supplier is willing to let client use its skills and competencies for dealing with new project requirements (Narayanan and Narasimhan, 2014). A high level of supplier flexibility, in particular, suggests that a client can easily share its ideas and solve problems with its suppliers. For example, when a client wants to make change its NPD project related requirements, it is easy for a client to communicate it new requirements and explore possible solutions for the new requirements. As a result, both clients and suppliers spent less of their resources in accommodation of new requirements and instead can use those resources for better value creation such as finding more fitting solutions for the new requirements in a timely manner. In essence, a higher level of supplier flexibility helps a client to achieve the desired project performance. Past research has also shown that the increased flexibility from suppliers help in completion of NPD project activities within time and budget. For example, Narayanan and Narasimhan (2014) found that a higher level of flexibility from suppliers leads to an increased performance in terms of time, budget, and quality. This perspective is also supported by the resource-based view (RBV) of the firm. According to resource-based view (RBV), clients outsource their activities to access the rare, valuable, inimitable, and non-substitutable complementary resources for enhancing their performance (Barney, 1991). Supplier flexibility is such a complementary resource that helps clients to efficiently responding to the new requirements in outsourced NPD activities. To summarize, supplier flexibility contributes to NPD project performance as it helps clients to efficiently deal with evolving NPD requirements. Based on the above arguments, we bring forward the following hypothesis:

H5: Supplier flexibility is positively associated with NPD project performance.

RESEARCH METHODS

Sample

To test our hypotheses, we used a cross-sectional survey design for collecting our data. The sample for our study was drawn from the REACH (Review and Analysis of Companies in Holland) database. We specifically focused on research intensive industries because firms functioning in these industries generally concentrate on new product development. Using the two-digit U.S. standard industrial classification (SIC) codes, the following six industries were selected: 28 (Chemicals and Allied Products), 30 (Rubber and Miscellaneous Plastic Products), 35 (Industrial and Commercial Machinery and Computer Equipment), 36 (Electronic and Other Electrical Devices and Components, except Computer Equipment), 37 (Transportation Equipment), 38 (Measuring, Analyzing and Controlling Instruments; Photographic, Medical and Optical Goods; Watches and Clocks Manufacturing). These six industries were selected because organizations operating in them are actively involved in intensive new product development. Within these six industries, we gathered contact details of 1502 companies that had more than 50 employees. Thus, the final sample comprised of firms that are active in research intensive industries and are involved in outsourced NPD projects. The data collection effort yielded responses from 109 client firms.

Measures

The face validity of the construct items was assessed by five management scholars who served as judges. The items were further refined and finalized based on a pilot study with six product development managers to test whether all the items were understandable and clear. Finally, the questionnaire was administered to the full sample. Drawing upon the extant literature on organizational controls, we compiled various items from mature scales to measure the three organizational controls: outcome, behavior and clan. Outcome control is a seven-item measure based on Atuahene-Gima and Li (2006), Bonner et al. (2002), Kirsch (1996), and Snell (1992). The measures for behavior control are adapted from Bonner et al. (2002), Carson (2007), Snell (1992), and comprises of six items. Clan control is a six-item measure, and is adapted from Kirsch (1996) and Kirsch et al. (2002). KIMs measures are adapted from De Luca and Atuahene-Gima (2007), and consist of five-items. Supplier flexibility consists of five items adapted from Bello and Gilliland (1997) and Gulati et al. (2005). NPD project performance is measured with five measures that are consistent with measures that have been previously used for measuring the performance of NPD projects. We consider NPD project performance as a formative construct as it is a manifestation of the five measures. These perceptual measures

Control variables

Five control variables were included in this study since alternative variables can account for supplier flexibility and NPD project performance. We included a dummy variable for product component. Product component of a larger system involves more complexity and requires frequent changes that makes supplier less flexible. Prior research has shown that component change of a larger system asks for more information exchange (Tiwana, 2008). We controlled for supplier team members as a large number of supplier employees represents a large pool of dedicated resources, potentially increasing NPD project performance (Tiwana, 2008).We also controlled for geographic proximity because a supplier that is located closely to a client is more flexible (Cannon and Homburg, 2001). Geographic proximity can also influence NPD outcomes due to the strong relational exchange between clients and its suppliers. The two variables relationship duration and prior projects accounts for the relationship history between clients and its suppliers. The duration of a relationship (years) has been found to influence the various relational elements of a client-supplier relationship (e.g.,Cannon and Homburg, 2001). Consequently, relationship duration may help explain the flexible behavior of suppliers. Also, clients and suppliers with relatively longer duration of relationship are more likely to align the project related activities and therefore influence project performance (Tiwana, 2010). The number of prior projects that has been executed together by a client and supplier can also potentially influence the relationship functioning (Carson, 2007), and hence performance (Gopal and Gosain, 2010). Appendix B provides the mean, standard deviations, and correlations of all the variables in this study Appendix C presents the constructs along with their items and control variables used in this study.

Construct reliability and validity

We took several steps to assess the construct unidimensionality, reliability, and validity. Given that NPD project performance is operationalized using formative measures, we did not consider it for further analysis as traditional techniques are not suitable for assessing its reliability and validity. First, we conducted exploratory factor analysis (EFA) using maximum likelihood extraction with promax rotation. We checked if all the construct items loaded onto their designated construct factors with small cross-factor loadings. While factor loadings above 0.30 are considered

to meet the minimum standard, factor loadings in the 0.40-0.50 are preferred (Hair, Black, Babin, Anderson, and Tatham, 2006). We deleted two items each for outcome control and KIMs, and one item each for behavior control and supplier flexibility (see Appendix C). The deleted items were those that either loaded low on all the five factors as these items did not represent any of the five factors or the items that loaded high (greater than 0.40) on multiple factors as these items could not distinguish between some of the five factors (Hair et al., 2006). The latter condition is important in order to ensure that the discriminant validity of the scales is sufficient.

Second, we further assessed the unidimensionality of all the constructs using confirmatory factor analysis (CFA) (Hair et al., 2006).. The CFA results suggest overall good fitting measurement model (χ^2 /df = 1.27, RMSEA = 0.05, SRMR = 0.07, CFI = 0.96, IFI = 0.96, and TLI = 0.95).We used Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE) values to establish the reliability and convergent validity of a construct. All the constructs have Cronbach's alpha, CR and AVE values above the desired level of 0.70 and 0.50 respectively, except for outcome control (Hair et al., 2006). While the AVE for outcome control (AVE =0.49) is below 0.50, but it is still within the acceptable level of 0.40 (Menor, Kristal, and Rosenzweig, 2007). Also, the CR value for outcome control (=0.80) is above the threshold of 0.70, we therefore kept the outcome control construct in its current form. We used the following two methods to demonstrate discriminant validity. First, we conducted chi-square difference tests for all the constructs in pairs to determine if the restricted model (i.e., correlation fixed at 1) is significantly poorer than the freely estimated model (correlation estimated freely). The chi-square differences are significant for all the 10 pairs suggesting that all constructs represent unique scales. Second, we compared the square root values of AVE with the inter-construct correlations. The square root of AVE values for each construct is greater than the corresponding correlations of each construct with other constructs as seen in. Taken together, the reliability, and convergent and discriminant validity tests indicate that the theoretical constructs exhibit acceptable psychometric properties.

Common method bias

We used CFA with single-factor technique to assess potential common method bias. The fit for single-factor model (χ^2/df = 1.82, RMSEA = 0.09, SRMR = 0.13, CFI = 0.88, IFI = 0.88, and TLI = 0.86) is considerably poorer than the five-factor model (χ^2 /df = 1.27, RMSEA = 0.05, SRMR = 0.07, CFI = 0.96, IFI = 0.96, and TLI = 0.95). Also, the chi-square difference between the single-factor and five-factor model is significant ($\Delta\chi^2$ (3) = 121.84, $p < 0.001$). We also used the CFA marker variable technique to assess the common method bias (Williams, Hartman, and Cavazotte, 2010). Using selection bias as the marker variable (see Appendix C), the analysis suggests that there is no significant improvement in the fit indices (model with only hypothesized variables vs model with both marker and hypothesized variables): χ^2/df = 269.05/212 vs 346.68/276, CFI = 0.96 vs 0.95, IFI = 0.96 vs 0.95, TLI = 0.95 vs 0.94. The difference in the chi-square values of the two measurements models is not significant ($\Delta\chi^2$ (64) = 77.63, n.s.) (Williams et al., 2010). These results provide some degree of assurance that common method bias does not seriously impact the findings in our study.

ANALYSIS AND RESULTS

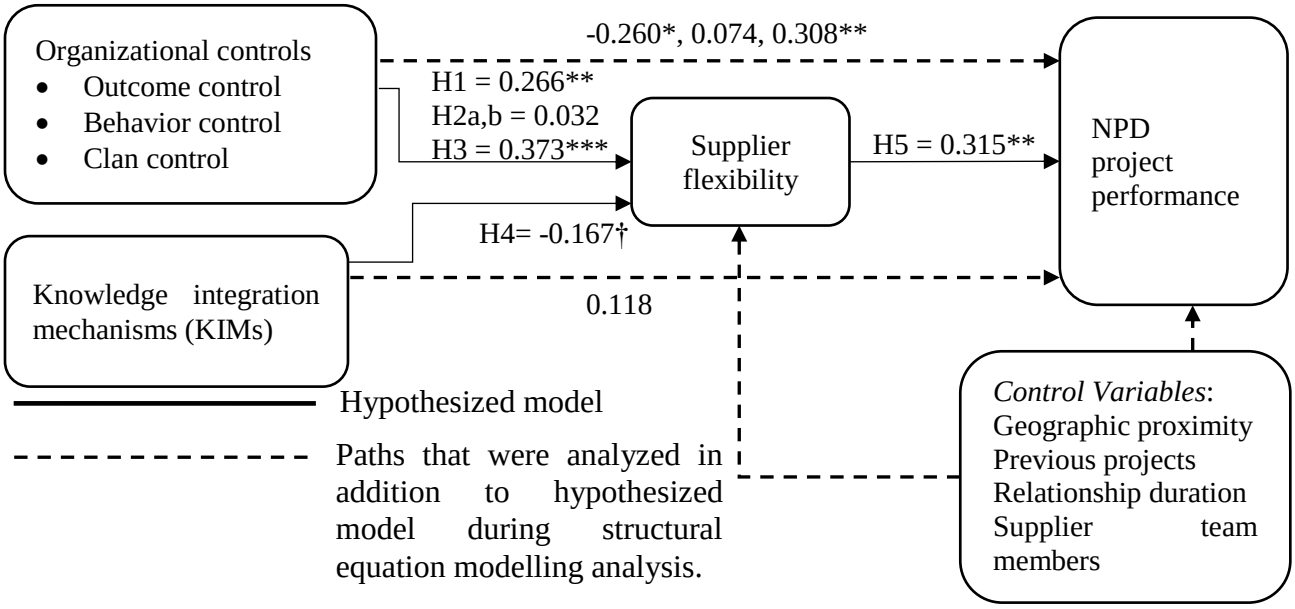
The hypothesized relationships were tested by performing structural equation modelling with bootstrapping option (Preacher and Hayes, 2004). Bootstrapping is a nonparametric statistical method that repeatedly samples from the available dataset with replacement and is particularly useful for small sample size (Preacher and Hayes, 2004). The number of resamples for the

estimation of bias corrected bootstrap intervals was set at 5000 and the level of confidence intervals was set at 95%. The fit indices values indicates that the model shown in Figure 1 Figure 1 fits the data very well: χ^2/df = 1.10; SRMR = 0.07, CFI = 0.98, IFI = 0.98, TLI = 0.97, and RMSEA = 0.03 (90% confidence interval: 0.00,0.083).

Hypothesized effects results

In Figure 1 and Table 1, we present the path estimates for the hypothesized relationships. H1 positively links outcome control with supplier flexibility. The path estimate for this path is significant ($\beta = 0.266$, $p < 0.05$). Thus, H1 is supported. Our results do not support both H2a and H2b as the estimate for the path leading to supplier flexibility from behavior control is not significant ($\beta = 0.032$, n.s.). In H3, we hypothesize that clan control is positively associated with supplier flexibility. The results show that the path estimate is positively significant ($\beta = 0.373$, $p < 0.001$), and hence supports H3. H4 predicts that KIMs is positively associated with supplier flexibility. We do not find support for H4 as the estimate for the path between KIMs and supplier flexibility path, contrary to our hypothesis, is negative and marginally significant ($\beta = -0.167$, $p < 0.10$). The estimate for the path between supplier flexibility and NPD project performance is significant and in the expected direction ($\beta = 0.315$, $p < 0.01$). Therefore, H5 is supported.

Figure 1: Results of structural equation modelling analysis with path coefficients



† Significant at $p < 0.10$, * Significant at $p < 0.05$, **Significant at $p < 0.01$, ***Significant at $p < 0.001$

Table 1 : Path analysis: standardized parameter estimates

Hypothesized Relationships	Standardized coefficient	Proposed Effect	Result
H1: Outcome control → supplier flexibility	0.266**	Positive	Positive
H2a,b: Behavior control → supplier flexibility	0.032	Positive and Negative	Non-significant
H3: Clan control → supplier flexibility	0.373***	Positive	Positive

H4: KIMs → supplier flexibility	-0.167†	Positive	Non-significant
H5: Supplier flexibility → NPD project performance	0.315**	Positive	Positive
Control Relationships	**Standardized coefficient**	**Control Relationships**	**Standardized coefficient**
Geographic proximity → supplier flexibility	0.027	Geographic proximity → NPD project performance	-0.038
Previous projects → supplier flexibility	-0.090	Previous projects → NPD project performance	0.271*
Relationship duration → supplier flexibility	-0.152†	Relationship duration → NPD project performance	-0.110
Supplier team members → supplier flexibility	-0.237*	Supplier team members → NPD project performance	0.014
Product component → supplier flexibility	-0.022	Product component → NPD project performance	0.102
Variance explained (R^2) supplier flexibility			0.370
Variance explained (R^2) NPD project Performance			0.321

Notes: †p <0.10, *p < 0.05; **p < 0.01; ***p < 0.001 (all two-tailed test). Significance levels are based on bootstrapped, bias-corrected confidence intervals.

Post hoc analyses: direct effects and mediation

To gain additional insights, we also conducted post hoc analyses in order to investigate the effectiveness of organizational controls (outcome, behavior, and clan) and KIMs along with examining the mediating effect of supplier flexibility on their effectiveness. Table 2 presents the detailed standardized coefficient estimates for total, direct and indirect effects computed for the mediation analysis. As seen in Table 2, the results suggest that the estimate for the path leading to NPD project performance from outcome control is significant but negative ($\beta = -0.260$, $p < 0.05$). Given the positive zero-order correlation between outcome control and NPD project performance (see Appendix B), a further analysis revealed that outcome control is a suppressed variable in relation to NPD project performance (see Appendix A for details). A statistical model should account for the suppression effect as it advances theoretical development because without the suppressor variable the relationship between an independent and a dependent variable may be smaller or maybe of opposite sign (Cheung and Lau, 2008; Maassen and Bakker, 2001). Therefore, one should combine the effects of both suppressor variable and suppressed variable for interpreting the results (Cheung and Lau, 2008). Since outcome control is a suppressed variable, the model without other predictors of NPD project performance underestimates the direct negative effect between outcome control and NPD project performance. Thus, by including behavior control, clan control, KIMs, and supplier flexibility in our model, we more clearly understand the opposing effects of outcome control in NPD outsourcing.

The results in Table 2 further demonstrate that the indirect effects of outcome control on NPD project performance is significant but in opposite directions, that is, positive ($\beta = 0.084$, $p < 0.01$). However, the total effect between outcome control and NPD project performance is not significant. As such, the results imply competitive mediation (or inconsistent mediation). Competitive mediation exists when both direct and indirect effects of an independent variable on a dependent variable exist but are of opposite signs and that may result in an overall non-significant effect

between the two variables (Zhao, Lynch, and Chen, 2010). Thus, supplier flexibility mediates outcome control—NPD project performance relationship.

Table 2: Standardized direct and indirect effects (Bootstrapping two-tailed test)

	NPD project performance								
Predictors	Total effects	LL 95% CI	UL 95% CI	Direct effects	LL 95% CI	UL 95% CI	Indirect effects	LL 95% CI	UL 95% CI
Outcome control	-0.171	-0.356	0.046	-0.236*	-0.450	-0.014	0.064*	0.013	0.171
Behavior control	0.057	-0.149	0.277	0.043	-0.172	0.256	0.014	-0.036	0.079
Clan control	0.369**	0.154	0.560	0.277*	0.041	0.508	0.092**	0.023	0.218
KIMs	0.093	-0.110	0.284	0.135	-0.069	0.331	-0.043	-0.135	0.007

Notes: *$p < 0.05$;**$p < 0.01$; *** $p < 0.001$ (all two-tailed test).LL= Lower Limit, UL= Upper Limit, CI=Confidence Interval.

As seen in Table 2, the direct and indirect effects of behavior control on project performance are not significant. Supplier flexibility therefore does not mediate behavior control—NPD project performance relationship. Concerning clan control, the analysis demonstrate that the path estimates for the direct ($\beta = 0.308$, $p < 0.01$) and indirect ($\beta = 0.118$, $p < 0.01$) effects of clan control on NPD project performance are positively significant. As such, supplier flexibility mediates the relationship between clan control and NPD project performance. The direct effect of KIMs on NPD project performance is not significant ($\beta = 0.118$, n.s.). In contrast, the indirect effect of KIMs on project performance through supplier flexibility is negative and significant ($\beta = -0.053$, $p < 0.05$), suggesting an indirect-only mediation (Zhao et al., 2010).

DISCUSSION

Organizations increasingly regard outsourcing of NPD activities to suppliers as a strategic medium for improving NPD project performance. The overarching objective of this study was to advance research on managing outsourced NPD activities. In this study, we investigate organizational controls and KIM as mechanisms that can be leveraged by clients to improve both coordination and cooperation with suppliers to enhance flexibility of a supplier for greater project performance. Using survey data from 109 outsourced NPD projects, we find that outcome and clan controls facilitate supplier flexibility, but the use of behavior control and KIMs do not enhance supplier flexibility. We also find that an increase in supplier flexibility results in higher NPD project performance. Our post hoc analyses also reveal that supplier flexibility mediates the relationship of outcome and clan controls with NPD project performance and KIMs have an indirect effect on NPD project performance via supplier flexibility. On the whole, this research offers significant contributions to the literature and implications for the practice.

Theoretical contributions

This study makes three important contributions to the extant literature. The first key contribution of this study is to unpack the direct effects of organizational controls on supplier flexibility in NPD

outsourcing. The results show that while outcome and clan controls are effective in increasing the willingness of suppliers to behave in a flexible manner, behavior control is not. As such, our results do not provide support for the traditional control research that has generally advocated exercising one control in a particular context (e.g., Ouchi, 1979). Further, the differences in how outcome and clan control affect supplier flexibility relative to behavior control may be explained by the fact that outcome and clan controls allow suppliers to select their own methods and procedures for completion of outsourced activities. In contrast, behavior control constraints suppliers from using their own idiosyncratic knowledge and that prevents them from responding quickly to the changes required by clients (Carbonell and Rodriguez-Escudero, 2013; Tiwana and Keil, 2007). Suppliers are therefore less willing to respond to changes in clients' requirements. However, since our results indicate that behavior control does not influence the supplier flexibility, the dysfunctional effects of behavior control are probably offset by its positive influence.

The finding that behavior control does not enhance supplier flexibility is also interesting in light of the suggestion made in the literature that a structured procedural methodology helps in dealing with unpredictable requirements (Gopal and Gosain, 2010; Tatikonda and Rosenthal, 2000). One plausible explanation for this difference could be that the use of a standard procedural framework is beneficial for alignment of interests only when it defines the boundary conditions for execution of development activities. The framework, however, can have an inconsequential role in enhancing supplier flexibility if it becomes too explicit in defining the procedures that suppliers have to follow while executing the NPD activities. Overall, we encourage future research to focus on a more detailed understanding of behavior control functioning in NPD outsourcing.

The second key contribution of our study is that it provides insights related to KIMs—supplier flexibility relationship in NPD outsourcing. Contrary to our prediction that the use of KIMs fosters supplier flexibility, we find that they do not influence supplier flexibility. The non-consequential influence of KIMs might be due to the perception differences between clients and suppliers (Chen et al., 2016). We believe that the use of KIMs is perceived differently by clients and suppliers. For example, when a client feels that the project requirements need to change and use KIMs for communicating information. However, its supplier does not see the need for the required changes. The supplier therefore perceives the use of KIMs by the client as a signal that the client does not trust the vendor and want to analyze something that has been done wrongly by the supplier. A client's use of KIMs will therefore not facilitate flexible behavior from suppliers. Previous research has also highlighted communication mechanisms overall not being effective between buyers and suppliers because of the difference in perception of buyers and suppliers related to such mechanisms in situations marked by variability (Oosterhuis et al., 2011; Yan and Dooley, 2013). However, our results do not disclaim the fact that the mechanisms that facilitate knowledge transfer between clients and suppliers are important. Rather, our results appear to call into question the claim that using knowledge transfer mechanisms will readily improve performance in inter-organizational relationships. This may or may not be the case based on how suppliers perceive the use of such mechanisms. Future research therefore needs to do an in-depth examination related to the role of knowledge transfer mechanisms in managing outsourced NPD activities.

The third key contribution of this study is that it elucidates the role of supplier flexibility in NPD outsourcing. Our results provides support for the assertion that flexible behavior from suppliers help clients to succeed in achieving higher performance (Narayanan and Narasimhan, 2014). Our post hoc analyses provide further insights related to the role of supplier flexibility in NPD outsourcing. The analyses suggest that supplier flexibility mediates the effectiveness of

outcome and clan controls, but does not mediate behavior control—NPD project performance relationship. Specifically, the analyses show that both outcome and clan control enhances NPD project performance via supplier flexibility. The post hoc analyses also demonstrate that KIMs indirectly diminishes NPD project performance via supplier flexibility. As such, supplier flexibility is one of the most important relational attribute between clients and buyers in NPD outsourcing that plays a critical role in the success of NPD projects.

Further, our post hoc analyses reveal that clan control also have direct positive performance consequences. A plausible explanation for the positive influence of clan control on NPD project performance is that they cultivate a channel of close interpersonal information sharing channels between clients and suppliers. A high level of close interpersonal information sharing channels that are bidirectional have been found to increase supplier's relationship commitment which embodies its intrinsic motivation (Anderson and Weitz, 1992). With regard to outcome control, the post hoc analyses show that it functions as a double-edged sword because the performance benefits achieved via supplier flexibility are balanced by the direct negative performance consequences of outcome control. Although the finding that outcome control diminishes NPD project performance needs further investigation because of the negative suppression effects, it provides support for the agency theory (Eisenhardt, 1989) assertion in the literature. Agency theory posits that rewarding controllees (i.e. suppliers) based on performance outcomes in settings that involve variability, such as NPD projects in this case, transfer risk to them as the achievement of outcomes is dependent on their actions (Eisenhardt, 1989). As controllees are risk-averse, they indulge in opportunistic behaviors and that leads to negative performance consequences. Collectively, this study's findings complements the contemporary work on controls that suggests that each organizational control functions distinctly (e.g., Turner and Makhija, 2006).

Managerial implications

This study provides fresh insights related to the mechanisms that can be exercised by clients to effectively manage their outsourced NPD activities. They should rely on mechanisms that emphasize specification of outcomes and development of common understanding between them and suppliers to effectively deal with emerging requirements as these mechanisms promote flexible behavior from suppliers. However, client managers should not specify those outcomes that are beyond the control of suppliers as such outcomes can transfer unnecessary risk to suppliers. Such unwanted risk can lead to suppliers indulging in opportunistic behaviors and that can decrease project performance. Therefore, they should be cautious in specifying outcomes that suppliers need to achieve and should select those outcomes that do not transfer unnecessary risk on its suppliers. Client managers should also prioritize those mechanisms that helps in development of shared values, norms, and understanding as these mechanisms not only leads to higher project performance by making supplier behave flexibly but also have other positive performance consequences. Further, client managers should be careful in setting up mechanisms that rely on specification of procedures and facilitate knowledge transfer between them and suppliers. Specifically, client managers should ensure that specification of procedures that suppliers need to follow do not constraint suppliers from using their own idiosyncratic expertise. Also, client managers should clearly explain the objective of using knowledge transfer mechanisms to suppliers so that their use are not perceived negatively by suppliers. Overall, client managers should take all the necessary steps to foster supplier flexibility, an important relational attribute in NPD outsourcing, for successful completion of their NPD projects.

LIMITATIONS

This research has several limitations. The first limitation is that the data used in this study is cross-sectional. Cross-sectional data limits the ability to make conclusions related to causality. Therefore, future studies should include alternative types of data, such as longitudinal or experimental data that allows scholars to examine the causal effect of organizational controls and KIMs on the project performance over the course of the project. The second limitation of this study is the use of self-reported data collected from single respondent within each firm. While the CFA techniques suggest that common method bias is not a serious concern, the possibility of some common method bias affecting the research findings cannot be ruled out. The third limitation of our study is the small sample size, which is similar to other studies at project level (e.g,Liu, 2015; Tiwana and Keil, 2009), as a large sample size is difficult to obtain at project level.

CONCLUSION

The goal of this study has been to broaden our understanding of the mechanisms that influence supplier flexibility, which plays a critical role in an uncertain environment that usually surrounds a NPD project. This study confirms that exercising outcome and clan controls facilitate cooperative behavior from suppliers and as such increases supplier flexibility. This study also reveals that the use of behavior control and KIMs do not foster supplier flexibility. In addition, this study reveals that supplier flexibility mediates the relationship of outcome and clan controls with NPD project performance. Our results suggest that outcome control acts as double-edged sword with regard to NPD project performance. On one hand, exercising outcome control leads to higher project performance as its use facilitate supplier flexibility, but on the other hand the use of outcome control leads to direct negative performance consequences. The results also demonstrate that that supplier flexibility helps to transform the increased cooperativeness of suppliers, due to clan controls, into higher NPD project performance. Our study therefore unbox the understanding related to distinct implications of mechanisms aimed at cooperation and coordination on supplier flexibility and its critical role in NPD outsourcing.

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Appendix A

Dealing with suppression effect

Conger (1974, pg. 36) note that "a suppressor variable is defined to be a variable that increase the predictive validity of another variable (or set of variables) by its inclusion in a regression equation". To check for the suppression effect, we used the procedure suggested by Maassen and Bakker (2001). We analyzed different regression models with outcome control and each of the other four predictors of NPD project performance (i.e., behavior control, clan control, KIMs, and supplier flexibility). The analysis reveal that the negative path coefficient between outcome control and NPD project performance became larger and significant when each of the four antecedents were also included as a predictor of NPD project performance in alternative regression models. Therefore, the analysis suggests that when the variance in NPD project performance due to behavior control, clan control, KIMs, and supplier flexibility was accounted for, the remaining variance correlated with outcome control revealed a negative relationship (Cheung and Lau, 2008; Maassen and Bakker, 2001). This indicates that the other predictors played the role of suppressors for outcome control (the suppressed variable) in relation to NPD project performance.

Appendix B: Descriptive statistics and correlations

		Mean	StdDev.	1	2	3	4	5	6	7	8	9	10	11
1	Outcome control	5.11	0.94	**0.698**										
2	Behavior control	3.25	1.53	0.410**	**0.852**									
3	Clan control	5.19	1.03	0.306**	0.041	**0.770**								
4	Knowledge integration mechanisms	3.63	1.39	0.398**	0.304**	0.268**	**0.771**							
5	Supplier flexibility	5.03	1.27	0.297**	0.108	0.412**	0.002	**0.837**						
6	NPD project performance	4.02	0.78	0.016	0.107	0.377**	0.136	0.340**	-					
7	Geographic proximity (0-1)	0.63	0.48	-0.117	0.056	-0.053	-0.168	0.064	0.005	-				
8	Previous projects	5.97	22.53	0.048	0.004	0.009	-0.006	-0.141	0.207*	0.052	-			
9	Relationship duration (years)	6.48	6.37	-0.162	-0.201*	0.134	-0.061	-0.154	-0.019	-0.081	0.350**	-		
10	Supplier team members (log)	0.49	0.30	0.266**	0.108	-0.080	0.207*	-0.220*	-0.111	-0.209*	-0.057	-0.092	-	
11	Product component (0-1)	0.35	0.48	0.037	0.346**	0.033	0.016	0.031	0.170	0.038	0.038	-0.186	0.019	-

Note: sample size =109. The diagonal represents the average variances extracted. Items below the diagonal are the inter-construct correlations.
**Correlation is significant at the .001 level (two-tailed). *Correlation is significant the 0.05 level (2-tailed).

Appendix C: Survey Measures

Measures	SFL
Outcome control: To what extent did you influence the external party by setting goals? *(α = 0.79 ; CR = 0.80; AVE = 0.49)*	
• We monitored the degree to which the external party achieved specific goals	0.77
• We evaluated the external party on the degree to which it achieved these specified goals	0.71
• We strongly emphasized attaining project goals	0.80
• We assessed the extent to which our organization adhered to predetermined budgets	0.52
• We set clear goals for the external party concerning the cycle time of the project	0.65
• We clarified which customer requirements the product should meet[a]	-
• We used prespecified technical specifications as a benchmark for evaluations[a]	-

Measures	SFL
Behavior control: To what extent did you control the external party project by specifying the procedures and processes to be followed? *(α = 0.92 ; CR = 0.93; AVE =0.73)*	
• We formulated detailed and comprehensive specifications for the procedures that the external party had to follow	0.78
• We specified the processes and methods by which the external party had to operate	0.96
• We monitored whether the external party operated according to prescribed methods	0.89
• Our evaluations of the external party were strongly based on how well they followed specified processes or procedures	0.86
• We strongly emphasized that the external party conducted the tasks according to our prescriptions	0.76
• We determined the actions that the external party had to take during the project[a]	-

Measures	SFL
Clan control: To what extent did you try to build a sense of unity between the members of your organization and those of the external party? *(α = 0.87 ; CR = 0.90; AVE = 0.60)*	
• We tried to achieve a sense of unity among the members of our organization and those of the external party	0.74
• We ensured that the members of the external party strongly felt part of the project	0.80
• We put considerable emphasis on achieving shared goals, values and norms between the members of our organization and those of the external party	0.64
• There was a strong sense of common spirit between our organization and the external party	0.82
• We tried hard to have good relations with the team-members of the external party	0.76
• There was a bond of trust between our organization and the external party	0.83
Relationship duration: For how many years has your organization been working together with the external party? …years	
Knowledge integration mechanisms: To what extent did the project use the following methods for capturing knowledge and information and communicating it between your organization and the external party? *(KIMs) (α = 0.77; CR = 0.80; AVE = 0.60)*	
• Regular formal reports and memos that summarize learning	0.49
• Formal analyses of problems in the project	0.98
• Formal analyses of pleasant surprises within the project	0.77
• Information sharing meetings[a]	-
• Face-to-face meetings between members of the different organizations[a]	-

Measures	SFL
NPD project performance (KIMs) (Formative construct) Please indicate the level of success of the project compared to the project goals for the following project outcomes.	
(1) Timing, (2) Budget, (3) Quality, (4) Technical Performance (5) General Satisfaction	-
Supplier flexibility: How would you describe the flexibility of the external party? *(α = 0.90; CR = 0.90; AVE = 0.70)*	
• They reacted flexibly in response to requests for changes	0.85
• They were open to revising prior agreements	0.79
• They had no problems with adapting to changes in the product requirements	0.84
• They were prepared to adjust initial agreements if this was required by the situation	0.86
• They would rather work out a new plan than hold on to the original agreements when an unexpected situation arose[a]	-
Product component: Does the 'product' under development concern a component of a larger system or an independent product? (0 = Component, 1 = Independent product)	
Previous projects: How many prior projects did you execute together with this external party? …projects	
Geographic proximity: Was the most important contact of the external party located abroad or in your own country? (0 = Abroad, 1 = Domestic)	
Selection bias (as marker variable) (a) Please indicate to what extent you agree with the following statements about yourself, (b) I generally work under high time pressure, (c) I generally work in a conscientious and accurate manner	
Supplier team members: How many employees of the external party worked on this project? … employees	

Notes: SFL = Standardized factor loading, α = Cronbach's alpha, CR = Composite reliability, AVE = Average variance extracted. All scales used seven-point Likert-type items except control variables. All scales were measured using anchors "1= strongly disagree" and "7 = strongly agree". NPD Project Performance items were measured using anchors "1 = much worse than preset goals", "4 = equal to preset goals", and 7 = "much better than present goals".
[a]This item was deleted from further analysis because of its low or cross factor loading.

Title:

Identifying partners outside existing networks

Subtitle:

How do corporate organizations search for startups?

Abstract:

Search for external knowledge has evolved to a strategic task for corporate organizations. Startups are a source for particularly novel and innovative product ideas. Our article analyzes search strategies for the identification of startups followed by corporate organizations. Therefore, we conduct a multiple-case study among eight firms within the automotive industry. Results highlight four organizational approaches, a detailed identification process and 11 search instruments. Our findings add to literature on external knowledge sourcing in the context of corporate-startup relations. Further, we contribute to purchasing literature by highlighting how organizations identify innovative partners outside their networks.

Keywords:

search strategies; corporate-startups relationships

Introduction

External sources of knowledge have become a necessary extension to internal innovation activities (Monteiro, Mol and Birkinshaw, 2017; Rosenkopf and Nerkar, 2001). Collaborations with customers, suppliers, universities or even competitors are a promising way to extend the own knowledge base in order to increase the firm´s innovativeness (Felin and Zenger, 2014; Laursen and Salter, 2006). Considering this potential set of external partners, suppliers seem to have the largest impact on product innovation (Un, Cuervo-Cazurra and Asakawa, 2010). Yet, suppliers' innovative potential is limited as described in a case study by Gassmann, Zeschky, Wolff, and Stahl (2010), which further shows how a new venture supplier, commonly referred to as "startup", has succeed at providing a truly innovative idea (a haptic feedback control device for automobiles). Therefore, startups as a specific knowledge provider have received growing attention (Weiblen and Chesbrough, 2015; Zaremba, Bode and Wagner, 2016). By collaborating with startups, corporations hope to benefit from the startups´ entrepreneurial characteristics, such as alertness, creativity, flexibility and willingness to take risks (Audretsch, Segarra and Teruel, 2014; Criscuolo, Nicolaou and Salter, 2012; Marion, Friar and Simpson, 2012).

Firms looking for innovative ideas search within distinct search spaces, which differ according to their proximity of existing knowledge (Knudsen and Srikanth, 2014). Local search builds on knowledge already in use (Stuart and Podolny, 1996), while distant search expands existing knowledge and often builds on external stimuli (Fleming and Sorenson, 2004; Rosenkopf and Nerkar, 2001). Existing literature on search for external knowledge analyzes the impact of various knowledge providers on firms´ innovation performance (Laursen and Salter, 2006; Leiponen and Helfat, 2010). More specifically, prior studies have shown that knowledge provided by startups increases the innovation performance of corporations (Dushnitsky and Lenox, 2006, Wadhwa, Phelps and Kotha, 2016).

Existing studies have also focused on how to identify specific external knowledge partners, applying search approaches like netnography for lead users (Belz & Baumbach, 2010) or competitions for suppliers in the early stages of firms' innovation processes (Langner & Seidel, 2009). In particular, scholars have so far focused on how corporations identify innovative partners within their supply base (Pulles et al., 2014; Schiele, 2006). Still, we lack understanding on how firms search for new innovation partners, such as startups, outside their networks. As startups are usually unknown partners without prior relations to the buying firm, the search for such partners is more challenging and requires much more effort compared to identifying established suppliers. Some research has focused on the identification of startups but is limited to mechanisms within external organizational structures, such as external scouting or sensing units (Gassmann and Gaso, 2004; Monteiro and Birkinshaw, 2017). As no prior study provides a holistic picture of approaches to identify startups, our research addresses the following main question: *How do corporate firms search for startups?*

To answer the research question, we conduct a multiple-case study among 8 automotive multinational corporations in Germany. Results show that established corporations set up external and internal organizational structures and use various instruments, such as pitch events and networks, to identify startups. By focusing on startups as a single source of external knowledge, we contribute to recent calls to better understand the activities necessary to search for innovative partners. Thus, we expand our knowledge mainly limited to the outcome of search activities (Monteiro and Birkinshaw, 2017). Further, we extend literature on the embedment of scouting units by showing three internal approaches. In addition, the role of purchasing in the innovation process is highlighted by explaining the involvement of purchasing managers in the search for startups (Schoenherr and Wagner, 2016; Wagner, 2012). From a managerial perspective, our results show how corporations can identify startups in order

to maintain their firm´s position in dynamic market situations (Anderson and Tushman, 1990; Bergek, Berggren, Magnusson and Hobday, 2013).
The paper is structured in the following way. First, we analyze literature on external knowledge sourcing in the context of corporate-startup relationships as well as boundary spanning literature. The following part describes the framing of the study and data. Next, we show the results of the study by illustrating organizational approaches, a search process and search instruments. The paper ends with a discussion of implications and future research directions.

Theoretical background

External knowledge sourcing and search for startups

Accessing external knowledge has evolved to an essential part of firms' overall strategies (Basu, Phelps and Kotha, 2016; Van Wijk, Jansen and Lyles, 2008). Various empirical studies show the positive impact of external knowledge on the innovation performance of the sourcing firm (Ahuja and Katila, 2001; Laursen and Salter, 2006, 2014). Corporate-startup collaborations differ in their closeness, flexibility and equity-involvement which has implications on their reversibility as well as the necessary commitment (Van de Vrande, Lemmens and Vanhaverbeke, 2006; Van de Vrande, Vanhaverbeke and Duysters, 2009). Prior research describes strategic alliances (Lavie, 2007; Stuart, 2000), corporate venture capital (CVC) investments (Dushnitsky and Lenox, 2006; Wadhwa and Basu, 2013) and mergers and acquisitions (M&A) (Ahuja and Katila, 2001) as successful ways to access external knowledge. But knowledge from distant industries and new partners, such as startups, becomes more important (Brunswicker and Hutschek, 2010; Gassmann et al., 2010). Therefore, corporations have started to create specific program-based collaborations, such as accelerators and incubators, to access this knowledge (Bergek and Norrman, 2008; Pauwels, Clarysse, Wrigth and Van Hove, 2016).
But why are startups a valuable source of external knowledge? Due to missing assets, experimentation with a large number of ideas is not possible (Burg, Podoynitsyna, Beck and Lommelen, 2012; Marion et al., 2012). Hence, startups are enforce to conduct focused and dynamic new product development (Cooper, 1981; Freeman and Engel, 2007; Rothaermel, 2002). Newly developed products increase their legitimacy and allow startups to quickly access market shares as well as early cash flows to sustain survival (Schoonhoven, Eisenhardt and Lyman, 1990). Thus, innovation capability is a critical variable for startup performance (Chrisman, Bauerschmidt and Hofer, 1998). Further, startups´ flexibility is ensured by its organizational structure, including short chains of command, due to its small firm's size (Kickul, Griffiths, Jayaram and Wagner, 2011; Rothaermel, 2002). In addition, startups have highly dynamic capabilities, a willingness to take risks, and a high growth potential, accomplishing a prime position for innovation, especially disruptive innovation (Criscuolo et al., 2012; Engel, 2011). Thus, forming ties and acquiring knowledge of startups "can be an important source for innovation and growth for the established firm" (Weiblen and Chesbrough, 2015).
In order to systematically search for external knowledge, corporations have installed processes and apply search instruments (Homfeldt, Rese, Brenner, Baier and Schäfer, 2017; Rohrbeck, Hölzle and Gemünden, 2009; Weiblen and Chesbrough, 2015). Scouting for external technologies and startups is conducted in an early phase of innovation processes and consist of identification, selection and evaluation (Rohrbeck, 2010; Salerno, De Vasconcelos Gomes, Da Silva, Bagno and Freitas, 2015). Lichtenthaler (2005) describes a six step search process to identify diversification opportunities, divided into: (1) definitions of search fields, (2) identification of business ideas, (3) validation of business ideas, (4) rough assessment of business ideas, (5) detailed analysis of business ideas, and (6) decision making. Some

instruments to identify startups are described in literature, e.g. AT&T Foundry identifies interesting startups "through the foundry's network or through a response to a call for proposals in a certain problem area - get the chance to pitch their idea at a Foundry event" (Weiblen and Chesbrough, 2015). Further, the role of (technology) scouts (Pauwels et al., 2016; Rohrbeck, 2010), scouting-units (Monteiro and Birkinshaw, 2017; Rohrbeck, 2010) or startup pitch events (Homfeldt et al., 2017; Weiblen and Chesbrough, 2015) received attention in prior research.

Boundary spanning to transfer knowledge of startups

Boundary spanning on an organizational level describes the openness of organizations towards external sources of knowledge (Dollinger, 1984; Leifer and Delbecq, 1978). Through boundary spanning, firms can access knowledge or capabilities to face current and future market needs (Rosenkopf & Nerkar, 2001). Prior research also addresses the question on how individuals collect and channel external knowledge to make it accessible for internal units (Tushman, 1977; Tushman and Scanlan, 1981). Another research stream analyzes the inter- and intra-firm interaction of teams (Ancona and Caldwell, 1988, 1992). On the one hand, boundary spanners, such as individuals, departments or business units, can be allocated close to current business practice ensuring a good link to internal experts (Hill and Birkinshaw, 2014). On the other hand, boundary spanners located outside the organization, e.g. within a specific business unit or a scouting satellite, close to external sources for knowledge (Basu et al., 2016; Keil, Maula, Schildt and Zahra, 2008). For our study we define boundary spanning units as "specialized entity that mediates the flow of information between relevant actors in the focal organization and the task environment" (Monteiro and Birkinshaw, 2017, p. 344).

3 Method

The purpose of our research is to provide a complete picture on how to identify startups as innovation partners by describing the underlying organizational structures and implementation of search. Therefore, we conducted a multiple-case study mainly based on interviews with experts within the field of startup management from an established firm's perspective (Eisenhardt, 1989; Yin, 2014).

3.1 Design and sample

Our sample consists of major firms within the German automotive industry. The automotive industry is recognized as one of the fastest changing and most innovative industries in the world economy, with corporations spending huge amounts of resources on the identification and development of innovation (Hüttinger, Schiele and Schröer, 2014; Ili, Albers and Miller, 2010). In order to establish a certain degree of variation and maintain comparability in our sample, we applied a theoretical sampling approach (Patton, 2005). All selected companies belong to the automotive industry and the selected suppliers are listed among the 100 largest automotive suppliers. We followed the assumption that larger corporations are the first to develop approaches to collaborate with startups, due to their high amount of resources available. The initial list of cases was extended by two original equipment manufacturers from the automotive industry to get further insights in their current practice. For an overview of the sample see Figure 1.

Data collection and sources

Data for this research was collected in two phases. In the first phase, based on secondary data, first insights on selected cases were obtained and served as case-specific preparation for the interviews (Eisenhardt and Graebner, 2007; Yin, 2014). Secondary data showed that several cases utilize an own corporate venture capital department, use public media to attract startups, organize startup events, and use their online appearance to address startups. Furthermore, the

cases provided information on corporations´ field of interest, possible collaboration approaches, and rough selection criteria. In the second phase, 13 in-depth semi-structured interviews were conducted. We followed a key informant approach including employees from innovation management, R&D, procurement, M&A, strategy, and corporate venture capital (John and Reve, 1982). A structured interview guideline was used. All interviews were conducted face to face or by phone. To increase the reliability, two researchers participated in the interviews (Eisenhardt, 1989). All interviews were recorded and transcribed. In total, the interviews yielded 10 hours of interview data and 196 pages of transcript.

Firm*	Product portfolio	Revenues (2016; B €)	Job title of interview partners	Duration of interviews
A	Supplier exterior components	10-50	(1) Head of strategy	52:17
B	Supplier electronics & software	> 50	(1) Investment Partner (2) Procurement manager	1:08:27 50:18
C	Supplier exterior components	10-50	(1) Senior manager M&A (2) Manager corporate strategy	51:34 45:23
D	Supplier powertrain components	10-50	(1) R&D manager (2) Head of corporate strategy	43:28 43:28
E	Supplier exterior & interior components	<10	(1) R&D manager	52:22
F	Supplier electronics	<10	(1) R&D manager	48:14
G	Car manufacturer	10-50	(1) Procurement manager (2) Director Partnering	24:01 44:32
H	Car manufacturer	> 50	(1) Manager business innovation (2) Manager Technology Scouting	52:05 22:14

*all firms are headquartered in Germany and belong to the automotive industry

Figure 1: Sample

Data coding and analysis

All data was analyzed and coded. Before coding, the initial review of data provided a first classification of results. In a next step, codes were given and redefined through the research to capture themes that emerged from the data. First, we analyzed each case individually to make sense of the data by structuring, defining, and reducing the collected information. In the following, we were able to define the corporations´ organizational structure, processes, and instruments to identify startups. After the single case analyses, the cross-case comparison followed. Here, we continuously reviewed all interview transcripts, where several patterns and themes were found. Based on detected similarities and differences qualitative statements on corporations' search approaches were abstracted. Assuming that larger corporations hold expertise in identifying startups the analysis includes best-practices form the identification of startups, triggering new research in this field and providing a foundation for hypothesis generation.

Results

Our results show that practitioners are looking for organization in their approach to identify startups, as it was described by an investment partner of corporation B: *"(the need for) more systematization, let's say, more standardized (in processes), with appropriate tool support."* In the following, corporations´ search approaches are analyzed. Addressing four different

organizational structures, one systematic process, and various instruments used to identify innovative startups.

Organizational approaches

Corporations use various organizational structures in order to identify startups (for an overview see Figure 2). The analysis of our data shows four distinct approaches which can be own organizational entities (referred to as central unit) or part of existing units (decentralized unit). Moreover, decentralized approaches can imply single or multiple business units. Further, central units can be differed regarding their distance to respective R&D experts which engage with startups in joint R&D projects by being an internal or external unit. Most of the time, setting up decentralized structures are initial steps to start searching for attractive startups. As the expert of Corporation F: *"(The corporation) decided to integrate technology and innovation management in R&D. Therefore, it is no central innovation management […] there is no separate function for technology scouting or startup monitoring."*

In contrast, centrally managed units pool demands and support trend scouting. Besides internal units, corporate venture capital or listening units exist and are examples for external units. An investment partner at Corporation B describes the role of such a unit in the following way: *"[…] everything concerning startups runs through this department […] (and we) get in direct contact with startups."* However, this organizational structure requires a strong link to internal stakeholders.

Structure	Description	Coupling to internal customers	Flexibility and speed
Decentralized – single functional	▪ Experts from one single department (such as R&D, procurement or M&A) involved ▪ Less systematic and standardized processes	Strong	Low
Decentralized – cross-functional	▪ Involvement of cross-departmental teams (including, e.g., R&D, procurement, M&A and corporate strategy) ▪ Systematic development of search field and approach based on internal demands and trends	Strong	Low
Central – internal	▪ Definition of search fields and monitoring of startup environment centrally ▪ Extensive communication among departments	Moderate	Moderate
Central – external	▪ Establishment of an external unit, such as, CVC unit, scouting satellite or listening post ▪ Extensive communication between internal and external department	Weak	High

Figure 2: Organizational approaches

Identification process

Our study shows that corporations have established distinct processes to operationalize their search for startups. The various search process are resembling and consist of the three main steps: definition of search fields, systematic search for startups and evaluation. Search processes for startups start with internal demands or external opportunities, such as described by the interviewed procurement manager of Corporation B: *"[…] technical departments, have some technical questions, problems. We then search for external knowledge providers. (Further we) derived (search fields) from mega-trends […]."* These demands result in search fields, which can be very specific as they search for solutions to specific problems. By being less specific,

firms allow broader search and enhance their chance to identify more distant knowledge (Criscuol, Laursen, Reichstein and Salter, 2017). Depending on their resources, corporations pick search instruments and decide how broad and intensive their search is designed. After applying these instruments, corporations end up with various ideas provided by different startups. These ideas are then validated and pre-selected accordingly: *"[…] the first pre-filter is of course, does it (the startup innovation) fit to our search fields."* (Corporation D, interviewee 2) Finally, depending on the type of collaboration, a thorough evaluation is conducted. Building on the identified approaches, we offer a consolidated identification process consisting of seven steps (Figure 3).

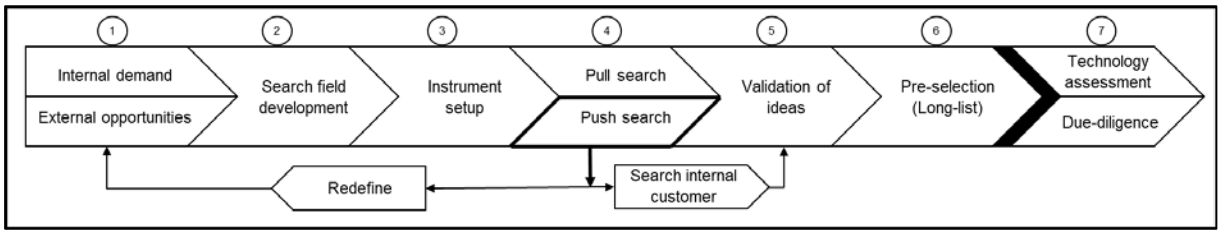

Figure 3: Identification process

Search instruments

Our analysis focuses on the design of the instruments, search approach, effort, and output as well as benefits and problems. By distinguishing in "pull" and "push instruments", we follow recent terminology for instruments within open innovation (Homfeldt et al., 2017; Wagner and Bode, 2014). While pull instruments require the initiative of corporations and active search, push instruments are rather passive, e.g., in a way that startups are introduced by external partners. The following section describes the identified instruments in detail (see Figure 4 for an overview).

The first identified pull instrument is desk-research. Most corporations start to search for startups by *"continuous screening of web-based sources"* (Corporation G, interviewee 1). An investment partner at Corporation B describes that they *"currently try to professionalize (startup scouting) by a web-crawler, which is able to scan for various search criterion within various media, especially within the internet."* Utilizing this instruments has a higher cost of implementation. Still, the yield of the instrument is a continuous screening of market deal-flows, limited to previously defined keywords. In order to enrich web-based search results, corporations buy external startup database services. Moreover, corporation uses *"scientific publications […] to spot interesting startups"* (interviewee of Corporation E). Experts within corporations visit scientific conferences to spot new technologies, talent and spin-offs. This instrument allows to spot future technology developments in an early stage. Similar are visits of trade fairs and exhibitions. This instruments requires an internal employee to visit startup fairs, conferences, and open pitch events. Often, these kind of events are organized by external service providers, as for example venture capitalists, in order to connect startups to potential industrialization partners and investors. Without preparation, the yield of this instrument for corporations is rather limited. However, by systematic structuring of these visits *"using a process, following the event catalog, […] dividing responsibilities across participants, […] and drawing up a summary of the event"* (Corporation D, interviewee 1), startup events are a good opportunity for first contacts to interesting startups and their founders. Furthermore, these events are an opportunity to build network connections and communicate the corporation's interest in collaborating with startups as new business partners. Another pull instrument are self-organized pitch. Depending on the setting of this instrument, startups and internal experts

of the corporation get in first contact and have the opportunity to discuss, for example, the commercial and technical aspects of startups innovation. In addition, our results show that corporations utilize fund of funds in order to continuously screen market deal-flow. This instrument utilizes the opportunity to invest in existing funds, referred to as "fund of funds". The usage of this instrument is described by an investment partner of Corporation B: *"We invested […] to benefit from their expertise and screen their deal-flow, this gives us the opportunity to match (startups to our search fields)."* Moreover, corporations invest in the service of external scouting partners. These partners search for innovative startups *"based on previously developed scouting request"* (Corporation C, interviewee 1). Requests are mostly based on corporations´ search fields and startups are matched by external scouting partners. External scouting services are assumed to be highly professional, yielding in high search outcome. The last pull-instrument are scouting satellites, which are external units set up within startup "hot-spots", like the Silicon Valley or Israel.

In addition to these pull instruments, we identified four push instruments. The first is networking with business partners as an instrument to identify innovative startups. Here, potentially interesting startups are communicated, e.g., through the value chain by suppliers. The R&D manager of Corporation D describes that they have a *"network with original equipment manufacturers and suppliers, exchanging information concerning a specific field of interest, where we just receive a phone call, asking for corporations´ interest into a specific startup."* Here, corporations are able to identify startups with minor efforts. However, they are dependent on the professional startup management skills of their suppliers. Other partners are venture capitalists. Furthermore, corporations use networks with non-partnering firms in order to identify innovative start-ups. This instrument describes the practice to build networks with customers, competitors or corporations form other industries to identify startups, which communicate information about relevant startups. In addition, organizations use networks to universities, public or non-profit research institutes to identify emerging startups, especially using *„direct contacts to university professors, are in continual exchange to get interesting information [about startups]"* (interviewee of Corporation E). Another passively managed push instrument to identify startups are landing- or web-pages. Within this instrument corporations are contacted by startups which are searching for new business partners. The establishment of such a contact possibility requires low effort by the corporation: *"on the webpage the startup is asked to provide general information […] (which are) automatically transferred into a database"* (Corporation H, interviewee 1). However, there is no opportunity for the corporation to filter the received applications, leading to a high effort in selecting the detected startups afterwards.

Instrument	Description	Continuous deal-flow	Effort	Output	Benefits	Drawbacks
Pull instruments						
Desk-research	Web based search, automatic web screening and external database services	Y	Low	Low	▪ Continuous screening of market deal-flow ▪ Straightforward implementation	▪ Depending on quality and breadth of database ▪ Time consuming
Scientific conferences/ publications	Visits of scientific conferences, reviewing publications	Y	Moderate	Moderate	▪ Identifying startups in an early stage ▪ Access to distant knowledge (different industries)	▪ Requires profound knowledge ▪ Time consuming
Trade fairs/ exhibitions	Visits of trade fairs and exhibitions	N	Moderate	Moderate	▪ Active search within search fields ▪ Marketing effect for corporation	▪ Preparation and post processing ▪ Time consuming
Self-organized pitch events	Organizing startup events with open registration	N	High	Moderate	▪ Intensive exchange of information between internal experts and startup members	▪ Requires high organizational effort ▪ Requires startups to be proactive
Fund of funds	Investment in VC funds managed by external venture capitalists	Y	High	High	▪ Investment in regional, industry specific, and multiple funds possible ▪ Continuous participation in deal-flow of VC	▪ Highly dependent on selected funds and investment managers ▪ High investment costs
External scouting partner	Scouting by external service provider	N	High	Very high	▪ Professional service provided by experts ▪ Breadth pool of startups	▪ High cost ▪ No direct screening of market deal-flow
Scouting satellite	Scouting department located in startup “hot-spots” managed by internal employees	Y	Very high	Very high	▪ Passive search due to local presence ▪ Active search based on search field specific scouting	▪ High implementation and maintenance cost

Push instruments

Networking with business partners	Communication of potentially interesting startups by business partners can be suppliers, consulting firms, VCs	N	Very low	Moderate	▪ Detection of startups within the industry ▪ Identification of industrialization partners	▪ Depending of profession startup management skills of suppliers
Network with universities research institutes	Potentially interesting spin-off firms are communicated by universities or research institutes	N	Low	High	▪ Early stage startups with innovative technologies ▪ Cross-industry	▪ Limited to institutes network partners
Network with non-partnering firms	Building a network with competitors, customers, and cross-industry parties	N	Low	Moderate	▪ Wide range of startups ▪ Low cost for implementation	▪ Difficult to find right partners in a unknown field
E-mail, landing-, and web-page	Online contact opportunity for startups	N	Low	Low	▪ Wide range of startups ▪ First administrative steps	▪ No filter opportunity ▪ Requires startups to be proactive

Figure 4: Search instruments

Discussion

Our study examines (1) organizational structures and (2) the implementation of search for startups. In the following we discuss our findings under the light of boundary spanning and external knowledge sourcing literature.

To start with, the four deducted approaches to organize the search for startups differ regarding the involvement of internal stakeholders and their closeness to the ordinary organization. One of the approaches describes an external, centrally organized unit, e.g., an overseas scouting (Monteiro and Birkinshaw, 2017) or corporate venture capital unit (Wadhwa and Basu, 2013). Our findings highlight difficulties in the knowledge transfer and boundary spanning for this approach due to missing links to the internal organization (Dushnitsky and Lenox, 2006; Rosenkopf and Nerkar, 2001). Further, internal centralized units also face the problem of missing intra-organizational links (Ancona and Caldwell, 1988, 1992). In contrast, internal, decentralized organizational structures limit possible constrains of not-invented here syndrome and missing absorptive capacity as project managers get to know startups and their ideas in at earlier stage (Cohen and Levinthal, 1990; Katz and Allen, 1982).

Regarding the implementation of search, the deducted process shows similarities to the identification and evaluation process for diversification opportunities deducted by Lichtenthaler (2005), which consists of search field definition, systematic search and evaluation. Our results also provide more details explaining, e.g., the definition of search fields and application of tools compared to prior research (Rohrbeck, 2010). Further, we highlight a specific search process for external knowledge which extends prior findings on, e.g., individual search for inventions (Maggitti, Smith and Katila, 2013) or general description of innovation processes on an organizational level (Salerno et al., 2015). In addition to the deducted process, we describe 7 pull and 4 push instruments to operationalize the search for startups. Several of these have already been described in prior literature on external knowledge sourcing (Laursen and Salter, 2006; Leiponen and Helfat, 2010). Searching within databases or the internet as well as attending trade fairs and exhibitions have been described as sources of external knowledge (Cruz-González, López-Sáez, Navas-López and Delgado-Verde, 2015; Leiponen & Helfat, 2010). Further, establishing networks to universities or research institutes as well as competitors (non-partnering firms) originates the same literature stream (Laursen, Masciarelli and Prencipe, 2012; Laursen and Salter, 2014). In addition, networks to business partner, such as suppliers, consulting firms or venture capitalist can offer additional deal-flow. Networks to venture capitalist can be enhanced by investments in their funds, commonly referred to as fund of funds (Dushnitsky and Lenox, 2005; Monteiro et al., 2017). Literature has also described internal and external technology scouts (Rohrbeck, 2010; Wolff, 1992). Especially, external scouting entities, e.g., listening post, are effective approaches to access knowledge provided by startups (Gassmann and Gaso, 2004; Monteiro and Birkinshaw, 2017). Innovation contests have been discussed in literature (Boudreau, Lacetera and Lakhani, 2011; Felin and Zenger, 2014). This approach to access external knowledge is very similar to self-organized pitch events as both require commitment and action of the external partner. Finally, startups can directly contact corporates via open channels, such as a corporate homepage. Thereby, startups follow a similar path as if applying for corporate engagement programs, such as accelerators (Kohler, 2016).

Theoretical contributions

Our research contributes to three major literature streams: external knowledge sourcing, boundary spanning and purchasing literature. First, our research contributes to the external innovation sourcing literature addressing startups as corporations' future innovation partners (Weiblen and Chesbrough, 2015; Zaremba, Bode and Wagner, 2017). While prior literature has mainly focused on established partners within the supply chain (Johnsen, 2009; Schiele, 2010), our study addresses the role of new venture supplier, referred to as startups, as providers of external ideas. Most scholars have focused on various external sources of knowledge, such as

suppliers, customers, universities or competitors (Criscuolo et al., 2017; Laursen and Salter, 2006). Just recently, the process to identify single sources of knowledge has been regarded in detail (Monteiro and Birkinshaw, 2017). Moreover, our findings provide 11 instruments to identify startups. As a consequence, our research adds to literature on open innovation instruments which allow firms to access external knowledge in a structured way (Homfeldt et al., 2017).

Second, we highlight four organizational structures showing how corporate organizations realize boundary spanning to access knowledge provided by startups (Rosenkopf and Almeida, 2003; Rosenkopf and Nerkar, 2001). These approaches allow corporations to link to the external knowledge providers (Basu et al., 2016; Souitaris, Zerbinati and Liu, 2012). Whereas prior studies have focused on external scouting units embedded in local startup environments (Doz, Santos and Williamson, 2001; Gassmann and Gaso, 2004), we highlight three internal approaches to organize the search for startups. Our findings, are in line with recent research emphasizing the importance of close bounds to internal organizational units (Monteiro and Birkinshaw, 2017).

Finally, our findings add to literature on the intersection of purchasing and entrepreneurship by highlighting ways to enhance supply chain relationships between established firms and startups. We thereby help to advance this understudied field (Kickul et al., 2011). By showing how purchasing departments contribute to joint search for startups, we support prior findings on the role of purchasing in the innovation process of corporate organizations (Schoenherr and Wagner, 2016; Wagner, 2012). Our findings illustrate how firms can search for innovative partners beyond established networks and extend the limitations of prior research exclusively regarding the identification of established partners (Pulles et al., 2014; Schiele, 2006). This is particularly important since the identification of startups requires a radically different approach compared to identifying established suppliers. Startups are usually unknown partners without prior relations to the buying firm and therefore a systematic search represents the basis for their identification. Existing approaches to identify established suppliers are not directly applicable to the identification of startups. Overall, this article provides adequate organizational approaches, search process and instruments to enable the search for startups.

Managerial contributions

Digitalization and sharing economy are only two trends which now even affect product-focused industries, such as the automotive industry (Richter, Kraus, Brem, Durst and Giselbrecht, 2017; Svahn, Mathiassen and Lindgren, 2017). As a consequence, existing technologies may become obsolete and the search for radical innovations with focus on digital products becomes a necessity. As startups are powerful partners to face these challenges, managers should consider them as future partners (Anderson and Tushman, 1990; Bergek et al., 2013). Our study provides four organizational structures which are used to organize innovation sourcing from startups. When selecting one of these approaches, managers should consider costs and efforts of their implementation. In order to operationalize search for startups, managers can select of a set of instruments which are highlighted in our study. Further, the described process to identify startups provides the basis for implementing structured search for startups.

Limitations and future research

Our research has limitations as findings may be specific to the automotive industry. However, “they might also be applicable to industries that have similar structural characteristics such as the aircraft, aircraft engine, semiconductor, medical device and consumer products industries” (Hüttinger et al., 2014, p. 713). Moreover, our case study is limited to a set of 8 cases and 13 interviews, abstracting data for a multiple-case study from a relatively small sample size.

As this study has explorative character, we were not able to evaluate which search approaches are most successful. Future studies could regard this from two ankles. On the one hand, an analysis of the impact of different organizational settings (internal/external and

centralized/decentralized) on the success of search for startups as well as on the innovation performance of firms would provide an important contribution. On the other hand, future research could focus on the effectiveness of search strategies. Is more intensive search and broader application of search instruments beneficial for the searching firm? Such studies would add to previous findings analyzing the effects of search breadth and depth for external knowledge (Laursen and Salter, 2006; Leiponen and Helfat, 2010).

In addition, our research is limited to the perspective of established firms. A further assessment on identification instrument could be obtained by taking the perspective of startups on how to identify future business partners. Moreover, an analysis on individual level could enhance our understanding of searching and scouting for startups, e.g., regarding the effects of "the presence of technology scouting units, and the adoption or involvement of different organizational structures in the external search process—on the success rate of development, identification, and integration of external knowledge" (Bogers et al., 2017, p.14). As identifying startups is only the first step to set up collaborations, future research could examine how corporations engage with startups to participate in their knowledge and how startups may support corporations to manage ambidexterity by balancing exploration and exploitation (Weiblen and Chesbrough, 2015; Tushman and O'Reilly, 1996).

Conclusions

Our study shows how corporate organization design their search for startups. We identify four organizational approaches and 11 search instruments. Our findings advance external knowledge sourcing literature as we identify internal approaches to organize the search for startups and instruments enabling the search for startups. By highlighting the role of purchasing in the search activities and showing how firms can identify partners outside their existing network, we advance purchasing literature as well.

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Archetypes of Decision-Making - International Purchasing vs Global Sourcing

Alina Stanczyk[1], Constantin Blome[2] and Martin C. Schleper[3]
1 EBS Business School, Germany
2 University of Sussex, United Kingdom
3 Nottingham University Business School, United Kingdom

Abstract
We investigate global sourcing decision-making (GSDM) processes by answering the questions 'which archetypes of global sourcing decision-making exist?' and 'how do contextual factors determine these types of global sourcing decision-making?'. The study highlights how differences in GSDM are explained by variations in contextual factors. A multiple case study approach drawing on 19 interviews and publicly available and internal data from buying firms was applied. 3 archetypes are identified (bureaucratic-discursive, pragmatic-impartial and political-unstructured) which are mainly influenced by the contextual factors global sourcing maturity, product complexity and leadership style. These factors determine companies' GSDM when global sourcing is a viable option.

Keywords: Global sourcing; decision-making; contextual factors

Introduction

While many researchers in the field agree that global sourcing is inevitable and/or lucrative for their business (Gelderman *et al.*, 2016) several other studies have failed to show significant benefits from its implementation (Vos *et al.*, 2016).
Although prior studies show that decision-making takes a pivotal role in the success or failure of global sourcing strategies (Kaufmann and Wagner, 2017), the topic of global sourcing decision-making (GSDM) has scarcely been scrutinized. So far, only few studies provide insight on how companies actually decide in respect of global sourcing (e.g.,Smart and Dudas, 2007; Moses and Åhlström, 2008) but why they undertake a certain path is still mainly opaque. Among the exceptions are the studies of Kaufmann *et al.* (2012; 2017), Akinci and Sadler-Smith (2012), Riedl *et al.* (2013) and Stanczyk *et al.* (2015) and Kaufmann and Wagner (2017) which provide a more nuanced and deeper understanding of the phenomenon by applying an organizational buying behavior (OBB) perspective.
Given the above contributions, different GSDM patterns are observable in practice and academia and although these prior studies describe the essential character of many GSDM processes they do not investigate contextual factors responsible for their emergence. However, research indicates that the decision-maker's task environment is crucial for understanding decision-making process variance (Elbanna and Child, 2007). In fact, two studies in the sourcing literature stream focus on the impact of contextual factors on GSDM. Kaufmann *et al.* (2012) test the influence of decision environments (dynamic vs. stable) on the relationship between procedural rationality and decision effectiveness whereas Riedl *et al.* (2013) examine the impact of organizational, situational and personal antecedents on the use of procedural rationality. These studies, however, do not claim to illuminate GSDM taxonomies. An exemption in this regard presents one of the latest studies in the field, in which Kaufmann *et al.* (2017) apply hierarchical regression analyses and provide a taxonomy of decision-making modes surrounding supplier selection.

Although operations management literature frequently utters the call for more research in behavioral operations management (Kaufmann *et al.*, 2014; Stanczyk *et al.*, 2017) and for a more rigorous investigation of the influence of contextual factors on actual decision-making processes and their variance (Papadakis *et al.*, 1998), this gap is a particular shortcoming of the operations management field, as strategic decision-making literature has already offered normative models of strategic decision-making processes for a long time (Shrivastava and Grant, 1985).

This study captures these calls and contributes to a vast stream in the operations management literature. The purpose of this study is to investigate GSDM archetypes along with their respective contextual factors. In doing so, this study seeks to answer the following research questions. (1) Which archetypes of global sourcing decision-making exist and (2) how do contextual factors determine these types of global sourcing decision-making?

By identifying patterns of variation of GSDM) processes which constitute GSDM archetypes, this study investigates the extent to which differences in decision-making processes are explained by variations in environmental, organizational and decision-specific factors. In doing so, the established definition of integrated global sourcing is adopted, according to which global sourcing refers to the proactive coordination and integration of common activities, items, processes, designs and technologies across worldwide buying centers within the purchasing function and across organizational functional groups (Trent and Monczka, 2003). The study differentiates between global sourcing and international purchasing, where the latter relates to a commercial purchase transaction between a buyer and a supplier located in different countries (Trent and Monczka, 2003).

Moreover, this study rests fundamentally on Stanczyk *et al.* (2015)'s findings by applying their same variables of the GSDM process, such as procedural rationality, functional politics and intuition. Based on the investigated relationships between those variables, the decision-making types are distinguished and contextual factors affecting them are determined. Due to a strong affiliation with the Stanczyk et al. (2015) study, a term global sourcing decision-making will be used as a general term for the decision-making across all global sourcing levels.

In order to answer the aforementioned research questions, a multiple case study approach is employed. In total, five cases of GSDM processes for complex purchasing components were investigated at firms from the mechanical engineering industry in Germany and Austria. The results show that three archetypes of GSDM can be identified (i.e., bureaucratic-discursive, pragmatic-impartial and political-unstructured) which provide a first step towards a taxonomy of GSDM process models. Further, global sourcing level, product complexity and leadership style are found as contextual factors that influence the emergence of GSDM archetypes.

Theoretical background

Decision-making in global sourcing

Scholarly knowledge about GSDM is still in its development stage. Prior studies emphasize that GSDM constitutes complex decision-making problems (Nydick and Hill, 1992; Smart and Dudas, 2007; Moses and Åhlström, 2008) as multiple different actors and numerous steps are typically involved in these contexts (Van Weele, 2010). Its complexity is additionally driven by a plethora of quantitative and qualitative factors and by an intrinsic difficulty of making tradeoffs among these factors. The wide range of aspects that need to be considered has caused many firms to employ cross-functional sourcing teams, which combine the spectrum of divergent expertise and skills necessary to make global sourcing decisions (Foerstl *et al.*, 2013; Golini and Kalchschmidt, 2015).

So far, only a few researchers have approached global sourcing at the decision-making process level in order to develop GDSM frameworks, however mainly by describing how these processes work (e.g., Smart and Dudas, 2007). Cavusgil *et al.* (1993), for example, developed

a descriptive GSDM process model which includes a wide set of common decision variables and the interrelations between these. In another study, Moses and Åhlström (2008) have portrayed the procedure of cross-functional sourcing processes and have identified factors that lead to a disruption of these processes, such as misaligned functional goals, functional interdependence and strategy complications.

Other researchers have shed more light on the behavioral aspects of GSDM, concentrating primarily on the procedural rationality dimension. Kaufmann *et al.* (2009) investigated how companies support rational supply management decision-making in the context of uncertainty. They identified three debiasing strategies: expanding bounded rationality of the decision makers, reducing dynamism and reducing the complexity of the decision-making environment. Further, Kaufmann *et al.*, (2012) link decision processes based on procedural rationality positively to higher decision quality (Kaufmann *et al.*, 2012), whereas Riedl *et al.*, (2013) find them effective in reducing uncertainty in supplier selection decisions. Other studies investigate the influence of intuition in sourcing decision-making with a positive correlation of intuitive decisions (Akinci and Sadler-Smith, 2012). New advances in the sourcing literature have been made by Kaufmann *et al.* (2014), who integrated intuition into GSDM by testing the effect of rational and intuitive decision-making approaches in cross-functional sourcing teams. They found that the cost performance (of the final decision) is enhanced in sourcing teams which applied highly rational decision-making (Kaufmann *et al.*, 2014). These findings suggest that too much focus on rational processes among the team members and the neglect of experience-based intuition can limit the effectiveness of the decision-making process (Kaufmann *et al.,* 2014). Stanczyk *et al.* (2015) assert that procedural rationality cannot be comprehended without examining politics and intuition at the same time, as those notions appear simultaneously with varying intensities and in different types. The study differentiates between two types of functional politics, namely assertive and negotiating politics. Whereas assertive politics affect procedural rationality negatively, negotiating politics have a positive effect on it. Similar to the opposing repercussions of politics, they find that creative intuition has a negative impact on procedural rationality, whereas justified intuition influences procedural rationality positively (Stanczyk *et al.*, 2015). Most recently, Kaufmann *et al.* (2017) investigate decision-making in sourcing contexts and develop a taxonomy of decision modes in supplier selection by applying a cluster analysis. Although their study focuses more on individual purchasing managers than on cross-functional sourcing teams, the taxonomy bases on rational, experienced-based and emotional processing and shows the possibility of providing meaningful taxonomies which support managers and sourcing teams in analyzing GSDM situations properly.

Overall, it can be concluded that although knowledge of the conduct, structure and behavioral dimensions of GSDM have been developed recently, the patterns that companies follow and their contextual factors have only very selectively been revealed. Hence, this study strives to extend the literature by sorting the apparent patterns of GSDM processes into GSDM archetypes and by investigating their contextual factors. Building particularly upon Stanczyk *et al.* (2015), this study applies the same process dimensions, namely procedural rationality, functional politics and intuition and recognizes the previously evidenced relationships between them.

Decision-making and contextual factors

To a large extent, prior OBB literature focuses on a better understanding of industrial decision-making processes and their antecedents, as well as on the influence of varying contextual variables (Sheth, 1996). As a main antecedent, the specific task environment was found to significantly determine the behavior of the participants in the decision-making process (Wilson, 1978). The most researched contextual determinants of industrial buying behavior are

novelty, complexity and environmental uncertainty (Lilien and Wong, 1984; McQuiston, 1989; Geok-Theng *et al.*, 1999). However, most of the findings provide mixed results with respect to their impact on the decision-making process.

While some researchers have found that higher environmental uncertainty induces firms to apply flexible ways of collecting non-routine and novel information from the environment (Spekman and Stern, 1979), others have suggested that a bureaucratic approach is crucial for the decision-making process in order to facilitate the gathering and processing of information (McCabe, 1987). Further, an increased complexity of the product requires that a larger number of technical experts are involved to develop and evaluate available alternatives (Kotteaku *et al.*, 1995), due to higher information requirements (Geok-Theng *et al.*, 1999). On the contrary, McQuiston (1989) did not find a significant relationship between complexity and the amount of communication in the decision process; moreover, Johnston and Bonoma (1981) did not confirm enhanced divisional involvement with an increase of complexity. With respect to purchase familiarity, OBB researchers agree that a rise in purchase novelty causes increased communication among decision-process participants (McQuiston, 1989) and higher levels of departmental representation in the decision-making process (Johnston and Bonoma, 1981).

Prior OBB research in respect to the influence of contextual factors on the decision-making process provides mixed results. In his literature review, Sheth (1996) contended that OBB research had changed dramatically since the 1970s and that many issues touched upon in the past had become obsolete. For many years, this research stream has not been fully exploited, particularly as it relates to global sourcing. In building on the OBB tradition, however, this study scrutinizes specific aspects of global sourcing, given that global sourcing is a complex phenomenon which reflects companies' contemporary buying behavior (as opposed to locally-oriented industrial buying behavior).

Some insights into the influence of contextual factors on the decision-making process can also be found in the strategic decision-making literature. However, these studies also produced mainly contradictory results. Fredrickson and Iaquinto (1989) argued that companies operating in stable environments have rational–comprehensive decision processes. Likewise, Stein (1981) contended that firms in highly dynamic environments follow less rational decision processes.

Until recently, few authors in the sourcing literature addressed the question of how environmental, organizational and decision-specific factors impact GSDM. Kaufmann *et al.* (2012) empirically tested the impact of the task environment on the relationship between procedural rationality and decision effectiveness in the supplier selection process. Investigation revealed that both in dynamic and stable environments procedural rationality influences decision quality in a positive way. Riedl *et al.* (2013) examined organizational, situational and personal antecedents of procedural rationality in the supplier selection decision-making process. Brief and contradictory remarks have been made with respect to the potential impact of global sourcing level on GSDM. In their work, Trent and Monczka (2003) suggest that in international purchasing the decision-making is opportunistic and is driven by need rather than by strategy, whereas global sourcing means that GSDM is planned and results from a global sourcing strategy. Conversely, Gelderman *et al.* (2016) found that, irrespective of the global sourcing level, critical incidents trigger global sourcing decisions. It is thus not clear what role global sourcing level plays in relation to GSDM.

The relatively small number of studies, of which most are surveys, which have investigated the relationship between GSDM and contextual factors leaves much room for further exploration of this topic. It is therefore important to gain a deeper understanding of which contextual factors are important for the GSDM process, how they affect it and to what extent they are responsible for the emergence of GSDM archetypes.

Methodology

This study applies a multiple abductive case study approach (Ketokivi and Choi, 2014). It builds on the case study work by Stanczyk *et al.* (2015) and extends its findings on the decision-making in global sourcing in terms of the influence of contextual factors on the decision-making. Following a purposeful sampling approach, key decisions were made in order to set the boundaries for the population covered by this research (Miles and Huberman, 1984). The case selection followed a structured process to ensure the greatest richness of information and at the same time to limit the number of cases necessary to achieve comprehensive insights (Perry, 1998).

In a first step, selection criteria were established in a way which ensured that the intended participants were supportive in pursuing the study's main goal; namely to identify GSDM archetypes and their underlying contextual factors. Johnston and Bonoma (1981, p. 254) noted that "no two purchases in any given company are ever exactly alike, nor will any two companies follow exactly the same procedure in two similar purchase situations, but at the same time, there should be some general patterns of behavior (…) which will be the same across even moderately dissimilar purchase situations". Thus, in order to detect such decision-process patterns and their determinants, this study opted for similar purchase situations. It is assumed that the organizational design and the applied processes are mainly dependent on the sourcing category, i.e. a group of similar items that are required for specific business activities (e.g., Van Weele, 2010). Processes for complex components are more sophisticated, relative to the buying processes for standardized goods in a single instantaneous act. Thus, the mechanical engineering industry was selected, in order to make the purchase situations comparable and to ensure the complexity of the sourcing projects and of the components sourced by firms within the same industry.

Furthermore, to assure division of labor at the functional level and at the individual level within the functions (Papadakis *et al.*, 1998; Elbanna and Child, 2007), large organizations were the focus of GSDM investigations. A revenue threshold of 1 billion EUR was selected for two reasons. First, large firms are more complex in terms of their organizational structures and their geographic sales and production facilities and second, their procurement operations are more dispersed than those of small firms. At the same time, the sample contained firms with global and regional supply chains to ensure different levels of global sourcing maturity (Trent and Monczka, 2003).

Subsequently, the sample has been limited to private firms headquartered in Germany and Austria, as these countries are major industrialized economies and their cultural proximity permits controlling for the legal and cultural environment of the home country and in order to assure that all firms' decision-making was primarily economically driven. Table 1 compares the five strategic business units (SBUs) across selection dimensions and industry subsectors.

Data collection and analysis

Case interviews were conducted based on a semi-structured interview guideline. Out of 9 companies which were invited to participate in our study, 2 we were unable to provide complete and reliable information concerning the same sourcing project. 2 additional companies failed to contribute significant new insights about the decision processes in global sourcing. Therefore, it was determined that we achieved theoretical saturation with 5 cases (Eisenhardt, 1989; Strauss and Corbin, 1998).

The interview protocol called for multiple informants from multiple functional areas who participated in a particular global sourcing initiative. In total, 19 interviews were collected, with three to four managers per organization involved in a GSDM project representing the purchasing, logistics, R&D, quality, strategy or controlling function. Each interview lasted 60-120 minutes. The data were recorded, transcribed and forwarded to each interviewee.

Consistent with state-of-the art case-study research rigor, multiple sources of information were used for triangulation purposes and to cross-verify findings (Eisenhardt, 1989). Apart from interview data, annual reports, web pages, market reports and internal documents, such as purchasing guidelines, policies and procedures were analyzed. Further, respected and established coding techniques (Strauss and Corbin, 1998) and quality safekeeping mechanisms were employed (development of a case study database, an independent coding of data and documentation, discussion of coding discrepancies).

Following the procedures of Miles and Huberman (1994) in a first step, the within-case analysis was conducted, which allowed to understand the decision context and the GSDM on an individual-firm basis. By drawing up within-case descriptions a comprehensive summary of the GSDM process of the cross-functional team and the surrounding context was generated. With respect to GSDM process, following the work by Stanczyk *et al.* (2015) process dimensions such as procedural rationality, intuition and functional politics were utilized.

Further, open coding of the interviews was conducted and the codes were organized into categories, continued by axial coding. More specifically, the aim was to look for contextual factors, which have been identified by comparing emerging categories with concepts from OBB and the sourcing literature, outlined in the literature review section. Some of the variables required certain adjustments (e.g., environmental uncertainty has been adjusted to technological uncertainty, as it is more relevant to the mechanical engineering industry context). Due to this approach, product complexity, purchase novelty and global sourcing maturity were validated as important factors for GSDM pattern emergence (Table 2).

Cases	Alpha	Beta	Gamma	Delta	Epsilon
HQ	Germany	Germany	Austria	Germany	Germany
Ownership type	Corporate	Family-owned	Family-owned	Corporate	Family-owned
Number of employees	~45,000	~10,000	~5,000	~10,000	~15,000
BU activity	World leading supplier of automation systems and services for machine tools and production machines in various industries. Develops and produces a range of controls with integrated motion control, logic and technology functions, as well as converters, servo and linear motors.	Manufacturer of material handling equipment, warehousing and material flow engineering systems, leader in the European market.	Provider of consulting and research/testing services for automotive industry. Deals with the development of test systems, instrumentation and powertrain systems, produces also electric powertrains.	One of the world's leading suppliers of engines and propulsion systems for off-highway applications and of distributed power generation systems. Produc es engines and propulsion systems for ships, for heavy land, rail and defense vehicles and for the oil and gas industry.	A world leader in drive technology and in drive-based automation sector, producing gear motors, gear units, motors etc. as well as drive solutions for automotive, transport and logistics, beverages and filling liquids.
Global presence of operations	Connected global operations	Connected manufacturing, R&D in Germany	Four production sites located in Europe and the US	Eight production sites across Europe and Asia	15 plants worldwide, centralized R&D in US & Germany
Sourced component	Electronic circuit system for motion control system	Lithium-ion battery cell for cranes	Air handling unit for the test system unit for combustion engines	Finished machined cylinder for industrial engines	Cooling element for industrial gear motors
Industry subsector	Motion control systems	Lifting and hauling vehicles	Automotive engine testing systems	Engines and propulsion systems for ships	Industrial drive systems

Table 1 Sample company characteristic

Construct	**Definition/operationalization**
Global sourcing maturity	An internationalization of sourcing process as firms develop worldwide experience, i.e. a progression from domestic sourcing level to the global coordination and integration of common items, processes, designs, technologies, and suppliers across worldwide locations (Monczka and Trent, 2003).

Technological uncertainty	Difficulty in predicting the future of a given environment, stemming from changes in technology (Dess and Beard, 1984; Sharfman and Dean; 1991), operationalized as an average number of patents granted in the industry (field) within the last ten years (based on Sharfman and Dean, 1991).
Product complexity	Product complexity can be determined according to five dimensions: functional, manufacturing, specification, commercial and political complexity (based on Homse, 1981 and Campbell, 1985).
Purchase novelty	A lack of experience of the decision-process participants with similar purchase situations (McQuiston et al.,1989).
Procedural rationality	Extent to which the decision process involves the collection of information relevant to the decision, and the reliance upon the analysis of this information in making a choice (Dean and Sharfman, 1993).
Intuition	Mental process based on gut feeling as opposed to explicit, systematic analysis, which yields an intuitive insight or judgement that is used as a basis for decision-making (Elbanna et al., 2013)
Functional politics	Intentional acts of influence to enhance or protect the self-interest of individuals or groups, shaped by goal misalignment and power imbalance among functions involved (Allen et al., 1979; Stanczyk et al., 2015)
Participative leadership	The leader shares the problem with his subordinates as a group. Together they generate and evaluate alternatives and attempt to reach agreement (consensus) on a solution. The leader does not try to influence the group to adopt "his" solution, and is willing to accept and implement any solution which has the support of the entire group (Jago and Vroom, 1977).
Consultative leadership	The leader shares the problem with the relevant subordinates individually, getting their ideas and suggestions. Then he makes the decision, which may or may not reflect the subordinates' influence (Jago and Vroom, 1977).
Negotiating politics	A type of politics driven by a combination of high goal misalignment and low power imbalance. This constellation prevents one function from dominating the GSDM process, instead leading to negotiations between the involved representatives about the most desirable choices (Stanczyk et al., 2015)
Assertive politics	A type of politics driven by a combination of high goal misalignment and high power imbalance, which leads to power abuse by decision-making participants (Stanczyk et al., 2015).
Justified intuition	A type of intuition that identifies a usage of intuition that is more based on prior experience, which can be more easily documented, shared and discussed with others and, thus be formalized to a certain extent (Stanczyk et al., 2015).
Creative intuition	A type of intuition that denote a usage of intuition that is based strongly on the more intra-personal and difficult to communicate gut-feeling component of intuition (Stanczyk et al., 2015).

Table 2 Major constructs definitions

	Alpha	Beta	Gamma	Delta	Epsilon
GS maturity					
GS strategy	Essential part of corporate strategy	International purchasing as part of sourcing strategy	International purchasing only when needed	One of the pillars of corporate strategy	International purc only when needed
Functional coordination	Direct and indirect materials are coordinated across worldwide Bus (approx. 60% of total volume bundled); specialized components are sourced at the BU level	Functional coordination of indirect materials across BUs, early functional coordination for strategic components (recently developed global purchasing procedures as a standardized process)	Functional coordination for standardized components occurs regionally; no coordination for complex products, sourcing procedures nonexistent; Limited exchange on supplier information, processes or technologies among purchasing units.	Exchange of technologies, processes and supplier information across worldwide BUs Majority of RFQs go through the global purchasing offices, which results in globally dispersed sourcing volume outside Europe, particularly in China, India and the US	No coordination e to bundle demand across individual Sourcing procedu specified; a gener exists that purcha commodities abo annual spend requ supplier quotation compared
Cross-functional integration	Sourcing strategies are aligned across functions within BUs supported by dedicated tools for cross-functional integration and existence of cross-functional sourcing committees	Alignment of functions to develop sourcing strategy in some categories within BUs; existence of cross-functional sourcing teams with predefined goals	Weak cross-functional integration; cross-functional teams do not exist, cooperation between functions based on need	Cross-functional integration is advanced especially for technically complex components; functional strategies are aligned in global sourcing	No integration am functions in terms processes or sourc strategy, cross-fur cooperation based
Abstract code	High	Moderate	Low	High	Low
GS motive					
	"The decision for Global Sourcing is naturally (around) the topics of cost, labor cost advantage, risk management, etc. It can also be local content requirement or requirements of our clients or achieving currency balance. (…) It is about taking advantage of the worldwide supply chain." *Head of Strategic Procurement*	"Eroding all possible sources from the price, logistics, customs, quality, security of supply point of view. Exploiting all possibilities and finding there the most adequate supplier. In fact, not only restricting to one country or one region but (*looking*) really globally." *Procurement Manager*	"Global sourcing is a little bit a vision from my side that it doesn't matter where the goods are coming from as long as they fulfil our specs, the quality is fine and the price is, of course, in favor of our needs. It means not only necessarily the cheapest, but the best mixture of price and quality." *BU Manager*	"Aiming at getting an optimum footprint in sourcing. This topic depends on especially where is our global production footprint, where are our customers, where is our business and then we try to find the best solution for suppliers. (…) At first, we want to have an optimum cost decision, the cost does not only relate to the price of the part but very much on the logistics. (…) And we also have to consider the exchange rates. There are several factors, not only the price." *Vice President Strategy*	"It was first, the cost and second, the know-how (i.e., technology) covered. It was a double hit." *Head of Procurement*
Abstract code	Balanced view	Balanced view	Cost/Quality focus	Balanced view	Cost/Technology focus

Table 3 Global sourcing maturity, Global sourcing motive and Leadership style

			Leadership style		
	"The final decision is a joint decision (…). The lead manager is, of course, the purchasing representative, but the decision is comprehensible for all parties involved and is of course well documented." *Vice President Strategic Procurement*	"We make the final decision together with the development department. (…) Yes, for this last filter stage, both areas are equally entitled to the weighting of the result. (…) And then we had to vote. We said however, ok both voices are equal and therefore it is quite normal the mathematical ranking." *Procurement Manager*	"The final decision in a project is made by the project manager. (…) So, in Europe it's me, but of course I rely on the local guys and I rely on the headquarter guys. And if there are (…) some questions marks, then, it is my task to figure it out (...) and then to make a final decision.." *BU Manager*	"Almost all of the decisions are much cross-functional (…). We have cross-functional meetings, where we discuss about what is needed, what is possible, what are the options. In the end, it is the final decision of the purchasing department." *Vice President Product Management, Strategy*	These four departments (production, logistics, quality, purchasing) are the partners who discuss together, (whether it) makes sense or not. In such a case, a proposal will be worked out. If it can be implemented, then it is the decision of Mr. K as the purchasing manager." *Quality Manager*
Abstract code	Participative	Participative	Consultative	Consultative	Consultative

Table 3 (continued)

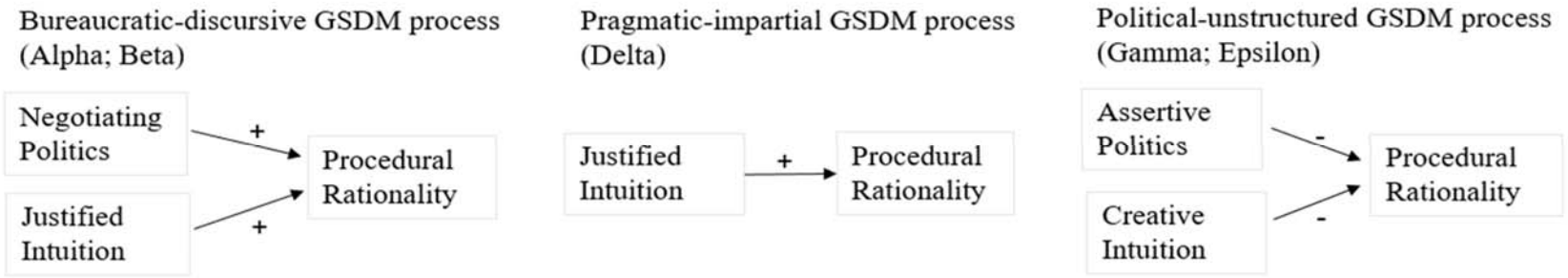

Figure 1: Global sourcing decision-making processes (adapted from Stanczyk *et al.*, 2015)

	Alpha	Beta	Gamma	Delta	Epsilon
GSDM type	**Bureaucratic -discursive**	**Bureaucratic-discursive**	**Political-unstructured**	**Pragmatic-impartial**	**Political-unstructured**
Decision process					
Procedural rationality	High	High	Low	High	Low
Functional politics	Negotiating politics	Negotiating politics	Assertive politics	-	Assertive politics
Intuition	Justified intuition	Justified intuition	Creative intuition	Justified intuition	Creative intuition
Contextual influence					
Global sourcing maturity	High	Moderate	Low	High	Low
Global sourcing motive	Balanced view	Balanced view	Cost vs Quality	Balanced view	Cost vs Technology
Technological uncertainty	111	14,35	118,38	63,72	231,86
Product complexity	Moderate	Moderate	High	Low	High
Purchase novelty	Modified rebuy/New buy	New buy	Modified rebuy	Modified rebuy	Modified rebuy
Ownership type	Corporate	Family-owned	Family-owned	Corporate	Family-owned
Leadership style	Participative	Participative	Consultative	Consultative	Consultative

Table 4 Cross-case comparison

Results

In the following, the findings of the study are presented in form of a taxonomy based on three identified archetypes based on the work by Stanczyk *et al.* (2015) and the key characteristics of each archetype are discussed. Introducing different archetypes means that a firm's GSDM process should be understood and described as a combination of multiple dimensions

Bureaucratic-discursive decision-making archetype

Alpha and Beta represent the bureaucratic-discursive GSDM archetype. It is characterized by high to modest *global sourcing* levels in which precise guidelines for the decision-making process for complex components exist and in which standardization of purchasing processes and an overall alignment of functional strategies within global sourcing projects are present (despite Beta's modest operations infrastructure). Beta's Procurement Manager admitted: "I need clearly defined partial steps to conduct analysis on good fundaments". Thus, the sourcing procedure in this archetype is cross-functionally designed to select suppliers purposefully.

The primary *global sourcing motive* in the bureaucratic-discursive archetype can be depicted by a balanced view (i.e., including the interests of diverse departments in the longer perspective). For instance, Alpha wants to cater the purchasing volume up to 100% where its production footprints are and at the same time to fulfill a set of goals, such as access to technology, lower cost etc. Moreover, Vice President for Category Management explains "we have discovered, that so called, Low Cost Country suppliers are, by all means, capable to support global for global," as a result, emerging countries sourcing accounts for 30% of total spend. At Alpha, there are three broad types of categories - full direct material, indirect material and sector specific material. Apart from the latter one, synergies are looked for when

purchasing globally. The product in scope is part of electronic category that belongs to full direct materials. Alpha is bundling approximately 60% of its total procurement volume, to achieve economies of scale. Once a year a commodity roadmap is developed for pooled materials. Among others for different circuit boards across the sites. The roadmap is cascaded from Purchasing Unit Council to the material team of a business unit and further it cascades to the particular site for electronics.

At Beta procurement is organized by product group. All sourcing needs are structured according to a group wide product management system that encompasses 40 main product groups. Beta's purchasing volume is broken down into production material, merchandise and indirect material. More than 90 per cent of the purchasing volume was allocated in Europe. Indirect spend is centralized at headquarters while direct component purchases are decentralized. In the studied case, the product in question belongs to direct spend.

Concerning GS motive, in the studied situation, Beta wants to better understand the global supplier landscape in terms of price, technological capabilities, logistics parameters and macroeconomic data and to use this knowledge efficiently, to pursuit of economies of information and learning. Purchasing Manager explains „the background was a new technology that we wanted to bring into our vehicles and we have had little knowledge of its global procurement market so far. (We wanted) to get acquainted with the new technology, ie the different industrialization progress and cost structures." The direct trigger for Beta's GSDM was finding a supplier of lithium-ion battery cell. The GSDM procedure developed for complex components required the identification of a large number of alternatives. According to Beta's Head of Production Logistics, "at least a hundred of potential suppliers are usually globally identified in this first phase. Afterwards, they are filtered according to macro criteria and narrowed down to the number of fifty". This sourcing procedure prescribes also the conduct of the analysis and the development of the final solution. Alpha initiated a GSDM process regarding potential new suppliers following a yearly supplier evaluation of electronic components and a capability verification of the global sourcing pool. Alpha's Head of Strategic Purchasing explained: "Once a year we ask ourselves in detail, if we can use additional options because of the topic of low-cost countries and (…) opportunities that could emerge from a changed supplier landscape."

In both cases, the *product complexity* was moderate and the *purchase novelty* was either high (Beta) or modest to high (Alpha) which instigated certain conflicts of interest between the purchasing and other departments.

In Alpha's GSDM process, the quality and the purchasing department's interests collided. As a result of yearly evaluation of the suppliers of the electronic components by a cross-functional sourcing committee, a new supplier has been nominated mainly due to better performance indicators in terms of quality compared to others. Quality Manager explains "you have to imagine we have different circuit boards and there are often process steps that go well beyond 300 different process steps, so and all this knowledge that people have acquired that cannot be easily wiped off the plate."Although a fairly good amount of electronic circuit board purchase experience existed, a potential new supplier provided new product specifications which is why extensive quality tests had to be conducted. The quality department insisted on the new supplier, whereas the purchasing department preferred to stick with the previous one, who provided better cost targets.

At Beta, an innovative type of battery cell for hauling vehicles had been considered from a new supplier. As Purchasing Manager explains „ the battery consists of the cell and the electronics; the electronics we can manufacture in-house, because we have our own electronics production but the cell we have to buy." Further he continues "yes that was the lithium-ion project, where many areas were involved. In addition to the product itself, the unit price, the logistics is crucial, because it is hazardous material goods and there are certain restrictions on transport (...) Here

I need the support of the development department not only to select the supplier on the commercial side but also on the technical side, because there are different technologies, different in chemicals. Also, different voltage levels and areas of application for the individual products and that must be analysed." Extensive worldwide search for supplier of an innovative product has been conducted by the purchasing. A Korean concern was nominated by technical department for further tests, as it fulfilled all technical requirements Nonetheless not all commercial criteria were fulfilled, thus Purchasing Manager had bad gut feeling towards that supplier. Extensive trial periods were required at an external scientific institute, as the product specifications were provided by the supplier. Given the high novelty in commercial and technical aspects, tensions between Beta's purchasing and development department could be noted when it came to cost vs technical adequacy of the supplier.

In the bureaucratic-discursive archetype, such differences of interest are alleviated through fact-based discussions and negotiations (i.e., *negotiating politics*) and the development of a solution is a common effort. In both GSDM processes, the purchasing department was *the lead* department for coordinating and collecting functional inputs. The purchasing representatives assured a transparent and open discussion among the sourcing committee and argued for the development of a common solution. Alpha's Head of Strategic Purchasing explained: "To solve (this conflict of interest) means to bring data, facts and objectivity into the discussion." Beta's Development Manager stated: "We discussed and came to conclusion we need to find a common solution, as our opinions are equally important." Thus, each party contributed equally and everyone felt involved in the decision-making at Beta.

Justified intuition in the form of personal experience codified in historic data is sometimes used as a decision support tool in the bureaucratic-discursive GSDM archetype. This is particularly the case when multiple suppliers are comparable in terms of hard criteria. Beta's Purchasing Manager admits: "One tries to support his gut feeling with facts. No one would accept pure gut feeling as an argument." In this archetype, the final decision is collectively reached by a democratic vote which reflects *participative leadership*.

Pragmatic-impartial decision-making archetype

Delta represents the pragmatic-impartial GSDM archetype. This archetype is characterized by integrated *global sourcing (high level of global sourcing)*, reflected in functional coordination across worldwide locations and mature cross-functional integration. Decision-making occurs according to standardized cross-functional sourcing-process guidelines for complex components. The sourcing procedure as well as the global sourcing infrastructure enable an extensive information search. Delta's Purchasing Manager explained: "We have defined what the buyer has to do, so he has the obligation to seek suppliers from the global landscape." The standardized sourcing process requires purchasing to collect at least four offers, which are evaluated with regard to commercial and technical performance criteria.

Similar to the bureaucratic-discursive archetype, the pragmatic-impartial archetype is also defined by a balanced *global sourcing motive*. In Delta's case this means to achieve an optimal global sourcing footprint, while at the same time to secure an optimum combination of price, logistic costs and technology level. This goal is supposed to be reached through long-term planning, the development of commodity strategies every 4-5 years and a related supplier review. Such a commodity roadmap development was also the trigger for the studied GSDM context.

Head of Strategy explains "our product portfolio is structured in a way that most of our products are low volume and high complexity so we don't compare to automotive industry that can source hundreds of thousands of the same pieces." Purchasing is organized in that the direct spend is decentralized, central purchasing for indirect goods and services exists, and there is also MRO business across all sectors. In the Onsite Energy and Components business unit in

the diesel engines division, the broad categories sourced are raw parts, finished parts as second source and medium-low tech. parts from low cost countries.
The component in question is a machined cylinder head for diesel engines, it belongs to direct spend, as a mid tech part. Those parts are sourced from low cost countries to achieve economies of scale. The Purchasing Manager elaborated "at the end of the day the final motivation was the total cost (…) we always look for the landed cost, so total costs of ownership is our decision making factor. We not only look on the export price of the supplier, we look at the quality performance, how are the audit results, how is the supplier dealing with flexibility etc."
In the analyzed decision-making situation, the *purchase novelty* was not as high as in bureaucratic-discursive archetype (i.e., modestly modified rebuy) as the new aspects related mainly to commercial aspects.
The engine's machined cylinder head was previously produced in-house; therefore, technology and specifications were already familiar and the overall *product complexity* was rather low. The greatest difficulty in this regard was evoked by commercial complexity, as Delta had decided to purchase the product from Brazil for the first time. The Purchasing Manager explained: "The process that we get finished machine components including assemblies from Brazil is a new step for us. (…) Because we do also in-house machining of this part, so we did in that case also make-or-buy study for our in-house production, we quoted and made an investment plan that we compared to two suppliers, one in Mexico and one in Brazil and (…) because it was more economical we sourced it out and not do it in-house. Then it went to the supplier in Brazil." The purchase novelty required the involvement from the engineering department in terms of knowledge exchange with the new supplier to secure a stable production process. Yet, their participation in the decision-making was rather limited, presumably due to the lower product complexity.
The role of the logistics department turned out to be more important: "Our parts are very big, for example, a crank cave of an engine is almost as big as a truck. Therefore, logistic costs have to be taken into consideration" (Head of Strategy). Nonetheless, this pragmatic-impartial archetype is marked by *goal alignment* and the absence of conflict of interests and hence *functional politics* in the GSDM process. Along these lines, the Purchasing Manager stated: "Strictly speaking, purchasing decides where we source, based on inputs from logistics" (i.e., the purchasing department is *the lead*).
During the coordination of the GSDM process, the purchasing department prepares an approval sheet in which all data (functional inputs) are collected for mutual transparency. As affirmed the Purchasing Manager: "We only move forward in the process if everyone is content". As well as in the case of Alpha and Beta, *justified intuition* serves as a support tool in final decision-making in the pragmatic-impartial archetype.
Yet, although the solution is truly developed in common by all participating departments, the final decision is made by the purchasing representative in the pragmatic-impartial archetype (i.e., *consultative leadership*).

Political-unstructured decision-making archetype
Gamma and Epsilon represent the political-unstructured GSDM archetype. It is characterized by low *global sourcing level i.e. international purchasing*. Epsilon pursues an international purchasing approach only when required and conducts its purchases from far-distanced countries through a purchasing agent. Although no standardized sourcing procedures exist, a general rule requires that large purchases for important commodities are based on 2-3 comparable supplier quotations and that the purchases are accepted by the company owner. Similar, Gamma also has no standardized processes and no specified purchasing procedures in place. Thus, GSDM participants are trusted to follow their own logic. Gamma's Business Unit

Manager explained: “We rely on common sense […] and everyone basically knows what to do.”

In the political-unstructured GSDM archetype, the primary *global sourcing motive* is to achieve rather short-term goals, with a main focus on low-cost sourcing and access to technology (cost vs quality at Gamma, cost vs technology at Epsilon).

At Gamma, standardized products are purchased via headquarters, whereas customized products are purchased locally by separate business units. The product sourced in the studied case was a sophisticated air handling unit for testing engines, the economies of information and process were looked for. The trigger for Gamma’s GSDM process was an emerging client order. Yet, the search for information was limited as the team usually relies on local suppliers in these cases.

At Epsilon, the purchasing structure is decentralized. Chief Procurement Officer describes “the plants worldwide are more or less self-sufficient (…) the world of Epsilon is very large worldwide. All decisions are taken rather locally.” In Epsilon’s case, a generation of sourcing alternatives was constrained from the very beginning as the sourcing direction was imposed by the Chief Procurement Officer (CPO) (i.e., *assertive politics*), who intuitively followed the general trend of sourcing from China (i.e., *creative intuition*) to achieve the economies of scale.

In the political-unstructured archetype, the *purchase novelty* is rather low. Gamma had previously bought a similar product and the Western Europe supply base is well-known. In this light, the Purchasing Manager commented: “We have plenty of known suppliers with which we already have some experience.” However, although the air-handling unit was highly customized, the technical specifications were new. For Epsilon, the product was also a slightly modified rebuy. Attempts had already been made to purchase the cooling element from local vendors before and the Purchasing Manager stated that “German suppliers cracked their teeth” on it. Thus, due to quality and technical problems as well as cost pressure, a new supply base had to be found.

On the contrary, the *product complexity* is rather high in the political-unstructured archetype. At Gamma, the component was characterized by a high manufacturing and functional complexity. The testing unit for combustion engines at Gamma had clear limits in terms of temperature, pressure and humidity and needed to be very well integrated as it was part of a larger test system. Thus, the Business Unit Manager explained: “In fact, building and delivering building components like this one is really complex, it is always customer-specific.” At Epsilon, the production of the cooling element involved four manufacturing processes which is why it was considered to be highly complex. The CPO elaborates: “technically it is not easy to achieve, because they (suppliers) need a very intelligent tool maker who masters the process so that the aluminum casting, the material is injected into a preheated form then it also needs to be cooled down intelligently. Material formation is then crucial to the cooling capability of this heat sink. It could be that it looks quite good from the outside but unfortunately does not have the right qualities. Still our own factory, we have our own aluminum die casting foundry in France, did not manage to do it right.” Furthermore, the distance of the potential supplier in China increased the purchasing complexity.

As a result, the political-unstructured archetype can be described as prone to conflict of interests. At Epsilon, the GSDM process became a source of disagreement between the purchasing and logistics departments because the storage design, consumption pattern and forecasts did not fit with purchasing’s strategy, i.e., ordering large batches from China to achieve unit cost savings. At Gamma, due to the high degree of technological advancement, the engineering department had a strong position in the decision-making process. Thus, Gamma’s Business Unit Manager complained: “They are so much down at the technical level”, meaning that it was possible for the engineering department to manipulate the GSDM process by providing questionable recommendations to select their preferred suppliers which caused

assertive politics. Similar, the emergence of *assertive politics* was observed at Epsilon. Due to a lack of experience in purchasing from China and in interaction with Chinese suppliers, the quality and the technical department were resistant towards a cooperation with Chinese partners.
Consequently, in both cases an individual who was *the lead* in the decision-making process independently developed a solution. At Epsilon, the CPO even withheld important information from the logistics department (i.e., *assertive politics*). At Gamma, the Business Unit Manager steered the decision process and managed the work of the purchasing and development departments. However, he also admitted to influence the GSDM process significantly (i.e., *assertive politics*): "I am challenging (the engineers) and, of course, purchasing is checking this at the end, if the figure is reasonable or if the way to come up with this figure was completely (…) crystal balling (…). I sometimes need to change an engineer in the project. Otherwise it would end up in a war."
At international purchasing level in the political-unstructured archetype, a certain latitude in the preparation of the analyses and solutions is present, leading to *creative intuition* in the decision-making process, such as relying on gut feeling (as mentioned above for Epsilon).
Finally, the final decision is made by the lead individual in the in the political-unstructured archetype (i.e., *consultative leadership*). Gamma's Business Unit Manager developed a solution independently, trying to manage the interests of the technical function, the procurement function and local commercial goals. Although he discussed and reevaluated the outcome bilaterally until all parties agreed he made the final decision on his one. Stressing the role and the responsibility of the purchasing department, Epsilon's CPO emphasized: "Basically, purchasing is in the lead, because we also carry the responsibility to ensure that it all works and that's why we make final decision."

Discussion

Throughout the study, three patterns of GSDM were identified: the bureaucratic-discursive, the pragmatic-impartial and the political-unstructured GSDM archetype. Two of the analyzed cases (Alpha and Beta) can be classified as the bureaucratic-discursive type, meaning that the decision-making process is characterized by high procedural rationality and the rationality is enhanced by negotiating politics and justified intuition. Delta represents the pragmatic-impartial type, where procedural rationality is strengthened by justified intuition. The political-unstructured type (Gamma and Epsilon) has low procedural rationality and the rationality is negatively influenced by assertive politics and creative intuition.
With respect to the contextual factors that account for the emergence of archetypes, some of the factors delineated in the literature were validated, while additionally new ones, such as global sourcing level and leadership style were found throughout the data analysis.
In the following, the interplay of the contextual factors and GSDM is discussed and the findings are reflected against existing literature.

Global-sourcing decision-making and contextual factors

Overall, support was found for the claim that different GSDM occur dependent on present contextual factors. As assumed, global sourcing level matters for the conduct of the decision-making process on complex components. This factor is the main contextual factor responsible for the emergence of GSDM archetypes. In organizations with more advanced global sourcing practices, the GSDM process was rationally driven, with political and intuitive behavior strengthening procedural rationality. This can be explained by the existence of standardized sourcing procedures. These procedures improve the scrutiny of the decision process since a more exhaustive search for suppliers is conducted and usually more sourcing options are generated.

Further, these guidelines reflect mature functional coordination and cross-functional integration. Thus, they first prescribe actions and second, secure goal alignment between different functions. Consequently, through clearly prescribed roles and responsibilities that frame the behavior and set the boundaries, negotiating politics and justified intuition are fostered to enhance the comprehensiveness of the GSDM in these cases. However, negotiating politics do not always occur in complex-components decision-making contexts of high global sourcing (i.e. integrated global sourcing) (or global-sourcing organizations as in the case of Beta).

In this context, the cases show that purchase novelty and product complexity are important contextual factors. Moderate to higher levels of purchase novelty (driven by both commercial and technical factors), as in the cases of Alpha and Beta, result in certain goal misalignment (i.e., conflicting interests) which activates a negotiating politics behavior (i.e., discussion and negotiations between the departments broaden the scrutiny of the analysis). Moreover, moderate product complexity requires different expertise and transparent information exchange, which is secured by the sourcing procedure, thereby enhancing procedural rationality. The sourcing procedure also enables justified intuition to formally contribute to final decision-making, thereby likewise strengthening procedural rationality. This leads to the first proposition:

P1. *In global sourcing the decision-making is characterized by bureaucratic-discursive decision-making archetype, when product complexity and purchase novelty are rather high than low.*

On the contrary, Delta demonstrated low product complexity and moderate purchase novelty – driven mainly by commercial aspects. This means that the required cross-functional expertise and information exchange was lower and the burden of novelty in this purchase situation was handled mainly by one function (purchasing). Due to decreased cross-functional interaction and a lack of conflicting interests, functional politics did not emerge. However, justified intuition enhanced procedural rationality and supported the final supplier choice, thus:

P2. *In global sourcing the decision-making is characterized as pragmatic-impartial decision-making archetype, when product complexity and purchase novelty are rather low than high.*

It was observed that in cases with lower levels of global sourcing - the international purchasing (i.e., Gamma and Epsilon) GSDM on complex components is less rational and procedural rationality is influenced by assertive politics and creative intuition. For example, the procedural rationality is lower, as the information search is less scrupulous and yields a limited number of alternatives due to the use of an intuitive analysis (creative intuition). Moreover, international purchasing means both immature functional coordination as well as cross-functional integration, which result in a lack of standardized sourcing procedures and a reliance on rather general rules. Such general rules give discretion to the lead individuals in terms of process design, its conduct and outcome.

Against this background, the contextual factor product complexity mattered for the studied decision-making contexts. In both cases, product complexity was high. Whereas Gamma's complexity was driven by technical aspects, Epsilon's was driven by commercial arrangements. However, for both organizations this resulted in conflicting interests among involved departments. Additional escalation was caused by moderate purchase novelty; another important contextual factor, which caused additional conflict between the departments with respect to new suppliers at Epsilon and Gamma. Since no clear roles and responsibilities were prescribed, there was plenty of room for assertive political behavior. As assertive politics replace the transparent data exchange and discussion and cause a deterioration in procedural rationality, it is proposed:

P3. *In international purchasing the decision-making is characterized as political-unstructured decision-making archetype.*

A contextual factor that emerged from the data that was not considered in the literature review is the global sourcing motive. The motive that includes the interests of diverse departments in the longer perspective, is multidimensional and goes beyond the short-term technology access or cost goals.is termed "balanced global sourcing motive". This motive is related to procedurally rational GSDM. Alpha and Beta show that a balanced global sourcing motive accompanied by participative leadership is characteristic of the bureaucratic-discursive decision-making archetype. The leader facilitates information exchange and moderates the discussion in case of conflicting interests, thereby fostering negotiating politics. This leadership style also enables equal departmental contributions to developing a solution and making a final joint decision, which ensures that different functional interests are reflected in the decision-making outcome. Thus, procedural rationality is supported.

Although a balanced global sourcing motive turned out to be a prerequisite of a procedurally rational GSDM, it does not automatically lead to the bureaucratic-discursive archetype. The case of Delta shows that a consultative leadership, accompanying a balanced global sourcing motive, constitutes a different type. The leader ensures that functional inputs are contributed in the development of the solution in a transparent manner, according to a balanced global sourcing motive. Yet, after following the input of the team, he makes the decision independently. This leads us to our second proposition:

P4. *Participative leadership facilitates global sourcing decision-making in conjunction with a balanced global sourcing motive such that it is characterized as bureaucratic-discursive decision-making archetype.*

P5. *Consultative leadership facilitates global sourcing decision-making in conjunction with a balanced global sourcing motive such that it is characterized as pragmatic-impartial decision-making archetype.*

A narrow global sourcing motive which focusses on two competitive factors in a rather shorter perspective is related to less-procedurally-rational decision-making. This is the case, if at the same time another contextual factor, such as consultative leadership occurs. The leader collects the relevant analyses from the involved departments. However, he uses inputs selectively in the development of a solution and makes the final decision individually, giving priority to preferred departmental interests. In those cases, the project leader facilitates assertive politics, for example, by deploying such tactics as withholding important information. Such tactics cause personal or departmental preferences to substitute for rigorous analytical methods and thus diminish procedural rationality. Therefore, it is proposed:

P6. *A consultative leadership style leads to a political-unstructured decision-making archetype when the international purchasing motive is rather narrow.*

Scholarly contributions

This study's approach to consider global sourcing level as an important contextual factor leading to certain GSDM archetypes turned out to prove right. The findings extend the view of Trent and Monczka (2003) concerning the character of decision-making at various global sourcing levels. According to these authors, international purchasing facilitates opportunistic decision-making, while organizations at higher global sourcing level carry out GSDM in a planned manner. The findings show that decision-making types at global sourcing level are rationally driven, as opposed to those at international purchasing level, where the decision-making is less rational, more opportunistic and intuitive (i.e., more political behaviors occur).

Moreover, two out of three contextual factors identified in the OBB literature were validated. Regarding purchase novelty, the findings partially agree with prior OBB studies, which claim that higher purchase novelty instigates higher departmental participation and increases communication (McQuiston, 1989; Johnston and Bonoma, 1981), as well as with Riedl et al (2013), who claim that for moderate to high purchase novelty decision-making is more rational. The cases show that in two decision-making archetypes purchase novelty induces increased information exchange. Moreover, decision-making is more rationality-driven in the

bureaucratic-discursive archetype, whereas it is less procedurally rational in the political-unstructured archetype. This is due to the fact that higher levels of purchase novelty activate functional politics. Further, depending on the combination of purchase novelty with other contextual factors (e.g., global sourcing level), this can affect procedural rationality either positively or negatively.

The second validated contextual factor, product complexity, turns out to be linked to all GSDM archetypes and the findings confirm some of the prior contributions. In line with Hillier (1975) and Kotteaku et al. (1995), the cases show that with higher product complexity more communication and divisional involvement occurs, which can be seen by comparing the pragmatic-impartial with the bureaucratic-discursive and political-unstructured archetypes. Due to low product complexity in the pragmatic-impartial archetype, a lower requirement for data exchange exists compared to the other types. As with purchase novelty, higher levels of product complexity activate functional politics. In fact, in the political-unstructured archetype, both purchase novelty and product complexity apparently enhance assertive politics and the use of creative intuition, which causes deterioration in procedural rationality. On the contrary, in the bureaucratic-discursive archetype, both contextual factors instigate negotiating politics, which strengthens procedural rationality.

The cases show that two of the analyzed contextual factors do not turn out to be fully valid or at all. On the one hand, technological uncertainty (in the literature environmental uncertainty) does not indicate clearly towards any GSDM type (see Table 4). High technological uncertainty appears in two cases representing the political-unstructured archetype, but at the same time, extreme values are present in the bureaucratic-discursive archetype. Extant research provides mixed results when it comes to the impact of environmental uncertainty. Some researchers claim that in stable environments the decision-making is predominantly rational (e.g., Stein, 1981), other that dynamic environments yield in higher rationality levels in the decision processes (e.g., Bourgeois and Eisenhardt, 1988). Our research confirms the contribution of Kaufmann *et al.* (2012) who found that relationship between the decision-making process and environmental uncertainty is indifferent.

On the other hand, a similar situation in terms of antecedent validity is visible with the type of ownership. Whereas the political-unstructured archetype cases (Gamma, Epsilon) are both family-owned, Beta, which is also family-owned represents the bureaucratic-discursive archetype.

A new contribution in the field of global sourcing is the identification of the decision-maker's leadership style as a contextual factor for GSDM archetypes. The participative leadership type has been identified in the bureaucratic-discursive decision making archetype, whereas consultative leadership has been identified in both the political-unstructured and in pragmatic-impartial archetypes. Further research could investigate whether another GSDM archetype exists in which less rational decision-making concurs with participative leadership style.

Last, this study highlights the role of the global sourcing motive for the GSDM process. Previous research discussed the global sourcing motivation only with respect to global sourcing level. Thus, integrated global sourcing has been found to be aimed at achieving competitive and comparative advantage and from an international purchasing perspective, mainly price benefits are expected (Trent and Monczka, 2003). This paper explores the global sourcing motive in more depth and links it to GSDM archetypes, thereby also presenting the interplay with different leadership styles.

Overall, following Papadakis *et al.* (1998), it can be concluded that contextual factors in decision situation have the strongest influence on the decision-making process. The findings of this research also suggest that organizational characteristics (i.e., global sourcing level) can present another critical factor for the GSDM processes.

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COLLABORATIVE WORKING CAPITAL MANAGEMENT
in automotive value chain: A longitudinal analysis

Feidias Stavrou, Luuk Perik, Janjaap Semeijn,
Department of Marketing and Supply Chain Management, SBE, Maastricht University
Tongersestraat 53 6211LM Maastricht
+31433883839
f.stavrou@alumni.maastrichtuniversity.nl l.perik@maastrichtuniversity.nl j.semeijn@maastrichtuniversity.nl

Summary
This paper examines the relationship between working capital cycles and firm performance in the automotive value chain. Recent literature suggests that industry-specific reasons may lead to different conclusions compared to conventional theory. Therefore, by using a repeated measures data-panel of 1058 firm-year observations between 2007 and 2016, we examined the relationship between firm performance and cash-conversion cycle (CCC) components. The findings indeed contradict conventional literature and suggest that increased firm performance is related to simultaneous reduction of payables and receivables cycles, while keeping longer cycles of inventories.

Keywords: Financial Supply Chain, Working Capital, Supply Chain Finance

Introduction

Supply Chain Management entails the coordination, planning and execution of inter-organizational arrangements related to the flow of cash, information and goods, from the raw material stage to the end consumer (Mentzer, 2001; Camerinelli, 2009). Significant research efforts have been undertaken from the academic community and the corporate world concerning the informational and physical flow of the goods in the supply chains, but not for cash flows (Wuttke, Blome, & Henke, 2013). Thus, when the 2008 financial crisis negatively affected credit availability, the cash flow processes of automotive corporations collapsed. The affected firms responded globally with a myopic optimization effort (Hoffman & Kotzab, 2010; Vasquez, Sartal, & Lozano, 2016), which included trade credit extensions from their suppliers in order to supplement their operations with other forms of financing. Under this environment, credit risk and capital financing costs were transferred from the dominant Original Equipment Manufacturers (OEM) firms to earlier stages in the upstream supply chain (Pohlem, Terrance, & Goldsby, 2003), increasing supply chain disruption risks. As a result, when the economy began to recover some firms were not able to finance their operations and participate in the economic recovery, leading themselves to the so called “working capital trap” (Hoffman, Maucher, Piesker, & Richter, 2011).

The questions that emerged from the aforementioned developments, caused the resurface of the financial supply chain management (FSCM) discussion. Despite the reemergence of this topic, research was fruitful only in incorporating financial flows and trade credit concepts into inventory models (Gupta, 2009; Àlvarez & Lippi, 2017). Furthermore, much of the research currently associated with this topic is still rather conceptual (Monto, 2013; Wuttke et.al., 2013). This suggests that the theoretical framework is not yet conclusive (Gelsomino, Mangiaracina, Perego, & Tumino, 2016). Thus, our first contribution is to research empirically the topic by using secondary data to validate previous conceptual research into financial supply chain management.

Furthermore, there are few comprehensive research efforts that cover this topic and even fewer to include more than first tier upstream suppliers, which contradicts what researchers propose concerning end-to-end supply chain management research (Vasquez, Sartal, & Lozano, 2016). One value chain that would benefit from such research is the global automotive industry as it was the one who reportedly neglected to manage its cash flows ((Zhao, Flynn, & Yeung, 2008) and it suffered during the credit crunch of 2008 which resulted in the bailouts of GM, Ford and Chrysler. Therefore, a second aim of our research is to implement an end-to-end value chain approach of five stages in the vertical and mature environment of automotive industry to reveal empirical trends at the value chain level.

Finally, the third contribution of our paper is the use of a longitudinal research design, which despite its ability to control for time effects (Kroes & Manikas, 2014) and its popularity among proposed future research (Weele & Raaij, 2014), is still scarce among the literature.

Consequently, the research question we aim to investigate is:

"*How do cash-conversion-cycle (CCC) components affect the firm performance of the companies which operate in the automotive value chain?*"

The structure for the rest of this paper is as follows: During the next section, the theory and the consequent proposition development is presented on the basis of working capital management (WCM), financial supply chain management (FSCM) and transaction cost economics (TCE) theory. In the third section, dataset construction and methodology are analyzed while in the fourth section the results of the research are outlined and discussed. The final section provides the conclusions, limitations and further research suggestions.

Literature Review and Propositions Development

Working Capital Management and Firm Performance

Working Capital (WC) is the amount of cash firms need to have for immediate use for their day to day operations (Mullins & Komisar, 2009). Accordingly, WCM aim is to reduce a firm's current assets portion to the lowest possible level. In other words, a firms' management must strive for the lowest account receivables while at the same time retain the right amount of cash to finance its operations without missing investment opportunities. Despite this goal, there is not a universal minimum level that fits-all situations and at the same time to maintain appropriate funding to execute business (Chen, Wang, & Lin, 2009; Popa, 2013). Thus, any miscalculation born from random variability and unpredicted circumstances could lead the firm to borrow too much money and decrease profitability or to borrow too late and reduce the ability of the company to get loans (Chen et.al. , 2009; Mullins & Komisar, 2009).

Working Capital can be approached from two perspectives. The first perspective is the more accounting one and revolves around the notion of Net Working Capital. The alternative and more related to this paper's perspective, is the process-related working capital (Monto, 2013). In WCM, this notion is directly measured from the cash-conversion-cycle(CCC) metric which represents the average days needed to convert a dollar invested in raw material into a dollar collected from a customer (Stewart, 1995).

CCC consists of three accounting based components (Table 1): First sub metric is the Days of Sales Outstanding (DSO) which resembles the average number of days between the sale of a product and the receipt of cash payment. The second sub metric, Days of Inventory Outstanding (DIO) resembles the average number of days that the stock value of raw materials, work in progress and finished goods of a company are converted into product sales. Lastly, the Days of Payables Outstanding (DPO) resembles the average number of days between the purchase from a supplier and the cash payment to that supplier (Table 1). The CCC is the sum of DSO and DIO minus the DPO.

Previous empirical research done mostly from the single-firm perspective revealed that the best strategy for increased firm performance is to maximize DPO and minimize DIO, DSO and CCC (Deloof, 2003; Garcia-Teruel & Martinez-Solano, 2007; Randall & Farris, 2009; Ebben & Johnson, 2011). This notion was consistently confirmed with alternative firm performance proxies and was recently further supported with longitudinal research which not only validated the above strategies, but uncovered a lagged effect of the CCC components in relation to firm performance (Kroes & Manikas, 2014; Huff & Rogers, 2015). More specifically it was revealed that firm performance can be affected today, by changes in DIO and DPO up to three years before.

The main criticism against this research stream is that it assumes only a single-company perspective (Losbichler, Heimo, & Rothbock, 2006; Protopapa & Seiffert, 2010; Hoffman & Kotzab, 2010; Monto, 2013; Wuttke et.al., 2013; Vasquez et.al., 2016) but when approached in a value chain setting "the gain of one is the loss of the other" (Losbichler et.al 2006). Accordingly, the empirical research and literature must also be extended to include

the fact that modern business competition occurs between supply chains and not mere firms (Rice & Hoppe, 2001; Larsen, 2007). Such extension is the proposal of the conceptual "supply chain-oriented perspective" WCM.

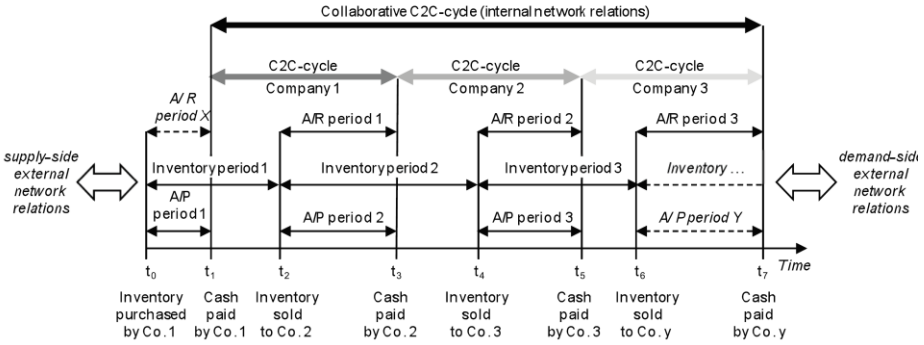

Figure 1 Supply Chain Perspective of CCC - Adopted from Hoffman Kotzab,2010

The main notion behind this theoretical perspective is that the companies which enjoy a high level of supply chain integration behave as one entity. External network relations of that "entity" follow the traditional single-firm perspective strategies as confirmed by most of working capital research so far. However, within the "entity" those traditional strategies are not applicable. As shown in Figure. 1 the A/R period (DSO) of Co.1 and A/P (DPO) of Co.2 are happening at the same time interval ($t_2 - t_3$) and cancel each other out. The natural interpretation in terms of Transaction Cost Economics, is that inner-cycle transactions costs become a bottleneck for the efficiency improvement efforts due to the unnecessary and redundant transactional costs of the "internal" payment periods. Consequently, the OEM firm (Co. y) has a strong motive to help coordinate upstream transactions.

The aforementioned concept can be observed through the effort of OEM firms to decide the payment terms with their suppliers by taking in consideration the second-tier suppliers as well. Data between 2012 and 2016, reveals a significant increase in the percentage of manufacturers who achieved total supply chain visibility (KPMG, 2012; KPMG, 2016) while at the same time senior managers have stated their preference to develop cost-to-serve structures (KPMG, 2016) in order to pinpoint cash flow and cost inefficiencies in their supply chains, especially when serving heterogenous customer profiles. These insights are evidence towards a general holistic approach and mindset from managers, something which further hints at a system level optimization like the supply chain perspective described above. Based on both theory and practice it can reasonably be assumed that the cash-conversion-cycle metric is only relevant at the value chain level of the automotive industry but not to any individual value chain stages. Proposition 1(P1): Cash-Conversion-Cycle metric is managed at the automotive value chain level

Another important implication from the "Supply Chain Perspective" collaborative approach relates to inventory. Assuming that the trade credit components are preferable to be managed at the system level, the only operation which can be available to local decisions is inventory. Modern inventory optimization efforts are closely related to the concept of lean management. Past research in lean inventory management (i.e. just-in-time etc.) produced mixed results concerning firm performance effects (Koumanakos, 2008), or even non-meaningful links between inventory leanness and firm performance. Results ambiguity caused the resurface of the discussion for industry-specific leanness (Haan & Yamamoto, 1999). More specifically it is stressed that the feasibility and desirability for leanness practices depends on specific production and supply chain conditions that relate to that industry's business model. Recent research confirmed this notion and more specifically that automotive industry related sectors experience increased firm performance when the inventory cycles increase (Eroglu & Hofer, 2010).

This seems to be confirmed in practice as well. In 2012 after the deep global recession was over, most popular challenge as voted by the CEOs in the automotive industry, was the ability of their supply chains to react in real time fluctuations of demand, while third most popular was the ability of their supplier's capacity to meet demand (KPMG, 2012). This can be attributed to their need to deal with fluctuations originating from increased market demand as the economies were recovering. Although, this notion comes in contrast with what the traditional perspective of working capital management instructs (i.e. negative DIO relationship with firm performance), it makes sense when observed

under the collaborative scope of (Hoffman & Kotzab, 2010). Therefore, it is reasonable to assume that on average, longer cycles of inventory in the automotive value chain can support firms' effort to satisfy increased yet volatile demand.

Proposition 2 (P2): Days of Inventory Outstanding in the value chain level is positively related with firm performance

Transaction Cost Economics (TCE) and Financial Supply Chain Management (FSCM)

As mentioned previously, there is not yet a conclusive theoretical framework for FSCM. To circumvent this limitation, we look for the help of TCE to complement our approach. TCE derives from the research of Coase (1937) Williamson (1981) and was used extensively as theoretical support in real world supply chain concepts such as vertical economic integrations (D'Aveni & Ravenscraft, 1994) and supplier performance and governance (Mahapatra, Narasimhan, & Barbierri, 2010). At the same time, is also applicable in the FSCM context due its association with uncertainty, opportunism and bounded rationality on transaction costs (Wuttke et.al., 2013).

The main concept to which TCE relates, is the optimization between the level of specialization (productivity) and the total amount of costs. The total amount of costs encompasses transaction costs and production Costs. Transaction costs are the sum of "all costs necessary to run a relationship" (Carr & Pearson, 1999) and along with the production costs they constitute the total cost of producing goods or services. As today the competition is between supply chains and not between companies, the Transaction Cost Economics theory becomes extremely relevant for the research at hand. From a certain point and further, a reduction of production costs comes at an exponential increase concerning transaction costs mainly due to information asymmetry and misalignment of interests (Hayek, 1945). Therefore, in TCE terms, the previously described supply chain perspective achieves the reduction of information asymmetry and misalignment of interests thus the minimization of transaction costs. In other words, the goal of FSCM can be considered to align the interests of all the implicated parties and keep the transaction costs at a manageable level but without sacrificing the level of specialization.

Indicatively, Financial Supply Chain (FSC) refers to the "holistic and comprehensive activities of planning and controlling all financial processes, which are relevant within a company and for communication with other enterprises" (Popa, 2013). One of the most cited and well-regarded concepts towards a unified FSCM theory is the dichotomy of FSCM before and after invoice release (Wuttke et.al., 2013). More specifically, a "pre-shipment" FSCM is defined as "the group of practices such planning, managing and monitoring cash flows along the supply chain, which take place before the actual delivery, quality control and invoice release". The second perspective is the "post-shipment" FSCM and encompasses "the practices that take place after the actual delivery, quality control and invoice release*"*. The latter perspective is essentially supply chain finance (SCF) practices.

More specifically, SCF solutions relate directly to trade credit components financing, like accounts receivables and accounts-payables of all the players in the value chain. The main goal is to help reduce account receivables of the suppliers but without a reduction in the accounts payables of the OEM firm (Haile & McDonald, 2012). In other words, the supply chain finance system owner, usually a financial institution, is funding the in-between period of these obligations allowing participating firms to receive payments earlier minus interest rates. This is achieved through an electronic database system which aggregates information and credit decisions on behalf of the OEM who initiates this scheme. This concept is documented to be used in automotive industry (Wuttke et.al., 2013).

Therefore, when seen under the supply-chain-perspective any effort from any supplier to extend its payables would harm the upstream tier supplier and probably would initiate an effort from that supplier to receive earlier payments from other of its customers or transfer this inefficiency to the pricing of its products (Viskari, Lind, & Karri, 2012). The result would be a domino effect to the whole supply chain and a subsequent deterioration in working capital positions. Therefore, for our third and last proposition it is reasonable to assume that on average the trade credit components, namely DSO and DPO are negatively linked with firm performance at the value chain level.

Proposition 3(P3): Trade credit components in the (DSO, DPO) value chain level are negatively related to firm performance.

Automotive Value Chain

The necessity for a holistic research led several researchers to turn to the value chain analysis. The concept of the value chain (VC) was first conceived by Michael Porter and is defined as the set of activities that a firm operates, within a specific industry, in order to deliver a valuable product or service for the market (Porter, 1985). Although the terms value chain and supply chain were not seen as the same concept in the past, due to the increased level of integration and collaboration, the two terms are currently used inter-changeably. In other words, it is not necessary for all the companies to work with all the rest in the value chain, but it suffices to add value in one way or another for the sector (Van-Weele & Rozemeijer, 1996). The automotive industry value chain was chosen for our research due to its maturity level, which allows as us to use it as template for all the problems most manufacturing industries will face sooner or later (Pirttila, Lind, Viskari, Schupp, & Karri, 2012) and because it was hit hard at the 2008 financial crisis.

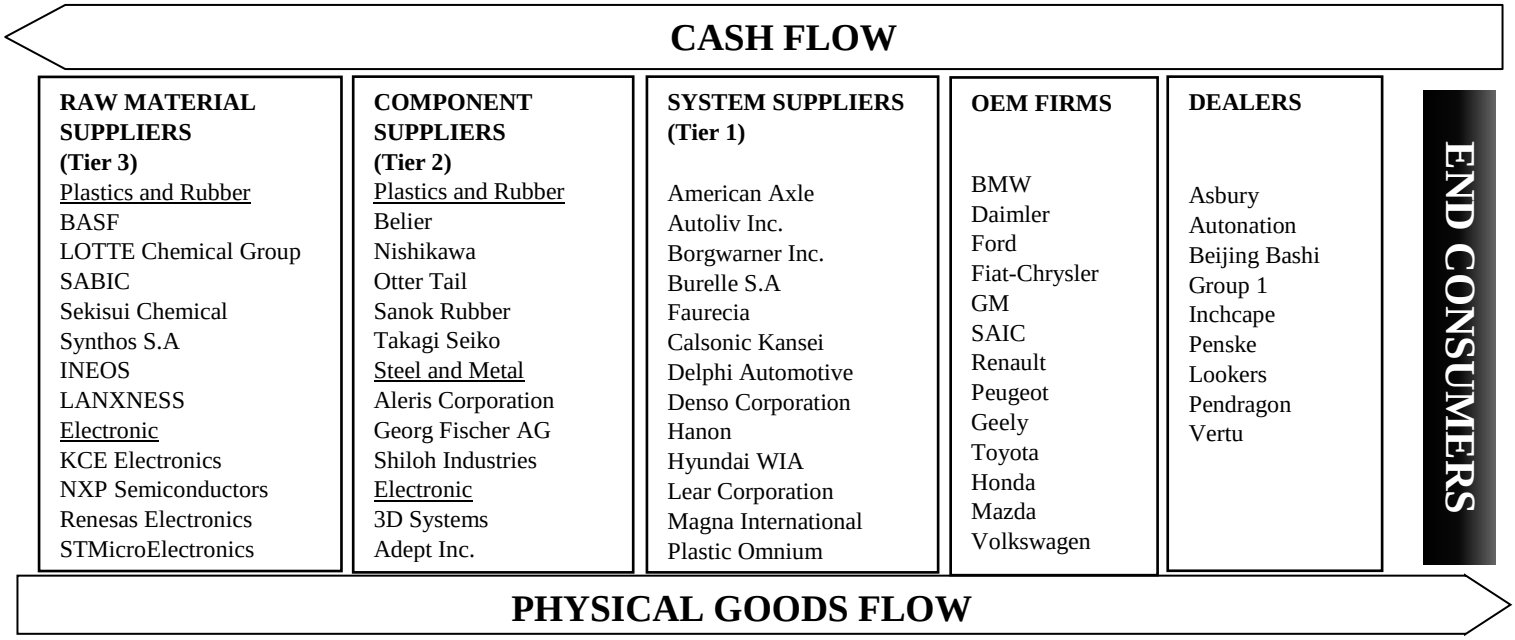

Figure 2 Value Chain Model(indicative)

Research Design and Methodology

Automotive Value Chain Model

Our research design adopts the automotive value chain model from past research (Pirttila, Lind, Viskari, Schupp, & Karri, 2012) and extends it to include data from 2007 to 2016. Our version of the automotive value chain model includes five stages (figure 2):

The first one is the refined materials components stage (tier three) which is divided to raw plastic/rubber materials and electronic component materials. In this stage components like coatings, catalysts, engineered plastics and semiconductor PCBs are produced and sold to the next stage. The second is the components stage (tier two) which includes plastic/rubber components, metal components and electronic components. In this stage plastic chassis, seat parts, metal structural components and electronic systems are supplied to the next level. The third one is the systems suppliers (tier one) which includes brake systems, full seating systems, power control units, airbags climate control systems etc. The fourth one represents the automotive original equipment manufacturers (OEM) which are responsible for the design of the car, the creation of the specifications, R&D, branding and final assembling and finally the fifth and last stage includes distributors/Retailers which include wholesalers and car dealers which buy cars and stock them to push them into the market.

Data Panel

To construct this paper's longitudinal data panel, FACTSET database was employed due the high quality of its post processing auditing services. This ensures the accuracy of this research and that the data are representative of the real world.

The value chain dataset for this research is similar to previous research (Pirttila, Lind, Viskari, Schupp, & Karri, 2012). Despite the commonalities, especially in the choice of the stages, there are some significant extensions to this paper's value chain data panel. Most important extension, is the use of the Supply Chain feature of FactSet. This feature shows the customers and suppliers for each of the firms used and solves the limitation of estimating the relationships (Pirttila et.al., 2012; Viskari et.al., 2012) or the criticism of uncritical use of databases (Moers, 2007). Therefore, the relationships in this dataset are not implied but accurately representative of the real-world supply chain relations. Furthermore, the Supply Chain feature shows the monetary value of the relationships and the percentage they represent to the total relationships of the firm. Any relationships that either did not include that percentage and/or the monetary value of a relationship, were excluded from the dataset. The rest of the relationships were ranked and the top suppliers/customers in terms of relationships and monetary volume were included. The reason for this choice is to include firms with big proven relationships which can be representative of the automotive industry. If any supplier of any stage could not be traced back to at least one supplier in the downstream tier, then the list was extended accordingly so there was at least one connection for that supplier. Finally, another significant extension of this dataset compared to its predecessor editions, is the adequate representation of all the important regions of the automotive value chain (US, France, Germany, Italy, China, Japan). In this manner, the dataset becomes more robust concerning the global developments in the industry.

Measures	**Abbr.**	**Calculation**
Days of Sales Outstanding	DSO	$\frac{\text{Receivables}}{\text{Sales}}$*(# of days in a period)
Days of Inventory Outstanding	DIO	$\frac{\text{Inventories}}{\text{COGS}}$*(# of days in a period)
Days of Payables Outstanding	DPO	$\frac{\text{Payables}}{\text{Sales}}$*(# of days in a period)
Cash Conversion Cycle	CCC	DSO+DIO-DPO
Tobin's Q	TobinsQ	$\frac{\text{Equity Value+Book value of LongTerm Debt+Net current liabilities}}{\text{Total Assets}}$
Debt to Asset Ratio	DEBT	$\frac{\text{Debt}}{\text{Total Assets}}$
Annual Sales'(in million dollars)	SALES	Sales

Table 1 Measures and Formulas

The resulting dataset includes 112 unique firms that had official public reports of their annual accounting and financial data. Since some firms reports did not include all the relevant data to this study, the sample set was reduced to 99 firms with data spanning from 2007 to 2016. The removed companies did not have full CCC components or metrics related to their balance sheet and income statements. Finally, the time span choice was based on the lack of data for a significant number of suppliers for earlier than 2007. The reason for this lack of data can be traced in different reporting regulations prior to 2007 in many regions around the world.

Dependent variable

Tobin's Q is the ratio of the market value of a firm to the replacement value of its assets (Tobin, 1969) and has been employed in a significant amount of past researches as a firm performance indicator in multiple topics (Dowell, Hart, & Yeung, 2000; Hennessy, 2004; Chen et.al., 2009). Calculating the exact value for this metric needs firms' disclosed information, so this paper utilizes the (Chung & Pruitt, 1994) approximation formula for which they showed that approximates the actual Tobin's Q measure by 95%. The formula is: Tobin's Q= (MVE+PS+DEBT)/TA where MVE is the market price per share of stocks multiplied by the number of stocks outstanding, PS represents the net current liabilities and DEBT the Book value of long-term debt. The sum of those parameters is divided by the book value of the total assets. If Tobin's Q>1 then the firm is doing an efficient job into replacing the value of its assets if <1 then not. In other words, the metric incorporates the market's view on how the companies' operations are managing their assets in the long term (Kroes & Manikas, 2014).

The reason for employing this metric instead of more traditional ones like RoA is threefold. Firstly, it has been shown that in automotive industry metrics like RoE, RoA cannot be linked directly to operational metrics because other aspects of firm management moderate and distort this relationship (Klinkenberg, Timberlake, Geurts, & J.Brown, 2013). Secondly, since inventory represents a significant portion of the assets under the control of automotive firms, this proxy is more suitable to represent the firm performance since its concept is linked to the value of assets replacement. Thirdly, Tobin's q has been linked to superior representation of firms performance (Wernerfelt & Montgomery, 1988) and in some cases to even superior representation of industrial firms' performance than other proxies like RoE, RoA etc (Lindenberg & Ross, 1981).

Control Variables

The models are controlled for four important parameters; that is debt, firm size, year and value chain stage. Firstly, controlling for debt is necessary because in the case of high-level debt, a firm could not receive any concrete contributions from cash that is freed from improved working capital position because that cash could be redirected to meet its debt payment deadlines (Capon, Farley, & Hoeniq, 1990). The formula depicting this control variable is the ratio of Total Long-term debt to Total Assets.

Secondly, the model is controlled for firm size because in the past firm size was linked to the market valuation of a corporation (King & Lenox, 2002). In other words, a company could be doing a terrible job in managing its operations but due to its sheer size of sales the financial performance metrics could show superior performance. Total Assets is omitted as a control variable due to potential multicollinearity issues (i.e. Tobin q) (Kroes & Manikas, 2014). To control for this parameter, the Annual Sales metric of the firms is used. Since in past research sales is linked to a non-linear relationship, for this model a natural logarithm transformation was applied to create the control variable. Thirdly, year parameter is included to control for any seasonal or short-term environment developments, which affected the industry that year and could distort the firm performances from year to year.

Finally, since this is a value chain analysis the value chain stages are control factors themselves. In many cases, the upstream supply chain, especially tier two and tier three suppliers, could be involved in other industries as well such as aerospace, motorcycles etc. thus their firm performance could be affected by developments found only in that stage (Pirttila et.al., 2012). Furthermore, suppliers are running on different business cycles, reduced profit margins and lower credit ratings. (The-Hackett-Company, 2012; Vasquez et.al.,2016). Therefore, a categorical variable for the value chain stage is included to control for any business parameters that are unique to each stage.

Statistical Analysis

The statistical analysis for this research paper was carried out by SPSS 24. Since the dataset panel is of repeated-measures, a General Estimating Equations (GEE) model was employed. The reason for using this technique over an OLS, is the capacity of the model to estimate the coefficients for data samples exhibiting high correlation between repeated measurements (Ballinger, 2004). This is a feature which is suited perfectly to this paper data panel. The link function used to apply the GEE for the model, is the linear one, thus the model becomes a Generalized Linear Model.

Furthermore, repeated time-series financial data like cash flow components are shown to exhibit a first order autoregressive correlation between subsequent time periods (Hui, Leung, & Huang, 1993). Therefore, the model is adjusted to control for first-order auto-regression AR (1) (Zeger & Liang, 1986).The resulting models are specified as:

CCC Components Model:

$$TobinsQ_{it}=\beta_0+\beta_1(StageNr)+\beta_2(ln\_Sales_{it})+\beta_3(Debt_{it})+\beta_4(Year)+\beta_5(DIO_{it})+\beta_6(DSO)+\beta_7(DPO_{it})+e_{it} \quad (1)$$

CCC Model:

$$TobinsQ_{it}=\beta_0+\beta_1(StageNr)+\beta_2(ln\_Sales_{it})+\beta_3(Debt_{it})+\beta_4(Year)+\beta_5(CCC_{it})+e_{it} \quad (2)$$

As this is a repeated measures data panel, *i* stands for firms and *t* represents the years. To further understand the breakdown of the results the above models are also used on each stage of the value chain separately.

Results and Discussion

Overview

Overall, the data panel even from the descriptive statistics (table 2) depicts an interesting landscape. The longest cycle of inventories can be found in Tier three (raw component stage) with the retail stage on a similar situation. For tier three suppliers, it can be attributed to the production model they follow, but also how the second tier organizes its production cycles as well. Retailers on the other hand, still show an extended inventory cycle and one can question whether the lessons of the 2008 US automotive bailout were indeed transferred to the future. The smallest cycle of Inventories can be found in the system suppliers and may be explained by the high level of integration between them and the OEM firms.

The biggest receivables cycle can be found to the OEM firms' stage. This finding confirms (Viskari et.al.,2012) research and shows that the practice of financing and leasing business of the retailers can affect when and how the car manufacturers will be paid. Moreover, CCC on average varies considerably between stages. The difference between the minimum and maximum CCC is over two months and can be found between the OEM firms and tier 1 suppliers, a fact that also may be the byproduct of integration policies. The second and third tiers are related with more days of cash conversion cycle than the value chain average (121) which poses interesting questions for the future, as to what are the factors contributing to this finding.

Finally, Tobin's q ratio is below one for this industry and by what the analysts explain, the automotive value chain players do not efficiently replace the value of its assets and their business model may not be sustainable. OEM firms have very low Tobin's q while the highest figure can be linked to the third tier. The results for Tobin Q, could be related to significant investments overall in the industry (high long-term debt).

Table 2 Data Panel Descriptive Statistics

Mean (St.dev)	**#of Firms**	**DIO days**	**DSO Days**	**DPO days**	**Debt %**	**Sales billion $**	**CCC days**	**Tobin's Q**
VC	99	53(33)	68(41)	54(23)	16(12)	22.4 (45.6)	121(53)	0.7(0.73)
Tier 3	18	70(35)	65(25)	52(17)	18(18)	10.763 (21.2)	135(43)	0.95(0.73)
Tier 2	31	55(29)	79(30)	58(19)	12(11)	3.281 (10)	134(43)	0.64 (1)
Tier 1	22	30(10)	56(10)	59(12)	18(12)	10.6(10)	87(16)	0.68(0.36)
OEM	15	47(17)	101(61)	61(29)	20(11)	10.(66.2)	148(46)	0.47(0.26)
Retail	13	69 (48)	25(28)	34(32)	15(10)	8.748(16.9)	94(66)	0.78(0.62)

Value Chain Analysis (Propositions Testing)

The results at value chain level are summarized in table 3. By the term "value chain level" this paper refers to the aggregated trends and findings of all the relationships included in this data panel. The analysis of the CCC components (Table 3) to the Tobin Q ratio shows that DSO and DPO are significantly and negatively associated with the average firm performance at the value chain level. The relationship is at an 1% significance showing that the

results for this research's scope are substantial. This means that for every additional day of DSO or DPO the average firm performance in the value chain decreases. Furthermore, DIO is also strongly significant at the 1% level and positively related to firm performance, meaning that on average, for every additional day of inventory outstanding the firm performance of the value chain will improve. These findings strongly support Propositions 2 and 3.

Our results contradict the previous findings of research between WCM and firm performance and may be interpreted with the collaborative financial supply chain management concepts described earlier in this paper. Accordingly, concerning the trade credit components (DSO, DPO) this research confirms the findings of (Viskari et.al., 2012). The practical implication of these results is that if the suppliers in the value chain begin to apply the short-term strategy of demanding payments earlier (DSO) and extending their own payment deadlines (extending DPO) they will eventually harm the value chain as a whole. On the other hand, the use of post-FSCM practices (supply chain finance) as already documented (Wuttke et.al., 2013) could interpret how the opposite result (lower DPO, DSO with higher firm performance) is achieved in the automotive industry. More specifically, post-FSCM actors take the role of the mediator and help the supply chain players of the value chain to plan better and simultaneously reduce their trade credit cycles.

In TCE terms, the simultaneous negative relationship between firm performance and DSO/DPO of the participant firms, relates to increased specialization (productivity) level but without any additional transaction costs that would result if such endeavor was to be employed without supply chain finance solutions. In other words, supply chain finance practices allow firms to avoid exerting their power to retain cash in expense of their suppliers (i.e. opportunism) and enables inter-firm cooperation (i.e. reducing environmental uncertainty and bounded rationality), thus rendering any excessive negotiations and credit collection costs etc. as redundant.

Table 3 Value Chain Level Results.

Independent Variables	**CCC Components (1) Coefficients (Std. Error)**		**CCC (2) Coefficients (Std. Error)**	
(Intercept)	-242.594***	(22.4241)	-62.399**	(27.2649)
Tier 3	0.282***	(0.0578)	-0.033	(0.0999)
Tier 2	-0.055***	(0.073)	-0.397***	(0.0925)
Tier 1	0.147***	(0.0126)	-0.052	(0.0744)
OEM	0.403***	(0.0554)	-0.177	(0.0542)
Retailer	0[a]		0[a]	
DIO	0.002***	(0.003)		
DSO	-0.004***	(0.003)		
DPO	-0.001***	(0.0002)		
CCC			0.002***	(0.008)
DEBT	0.136	(0.1769)	0.146*	(0.0861)
Ln(Sales)	-0.102***	(0.0173)	-0.094***	(0.0128)
Years	0.121***	(0.0111)	0.032**	(0.135)
QIC (fit stat.)	23.848		568.934	

Table 3 shows the models as described in the methodology section. Model (1) resembles CCC components (DIO, DSO, DPO) to the firm performance (Tobin Q), (2) the Cash-to-cash cycle to the firm performance (Tobin Q) on the value chain level.
*0^a = reference stage for categorical variable , *p<0.1 (10 % significance), **p<0.05 (5% significance), ***p<0.01(1% significance)*

The second important finding concerns the positive relationship of DIO with the firm performance (proposition 2). This finding contradicts the traditional single-firm perspective literature which predicts negative relationship between the length of inventory cycles and firm performance. One plausible explanation for this finding could be the relatively long production cycles and the unique nature of automotive industrial engineering in comparison to other industries (industry-specific theory). More specifically, due to the relatively time-consuming and sensitive assembly processes that govern this industry, inventory stock (including raw materials, work in progress and finished goods) need on average longer cycles to support variations during the production cycles. A second explanation could be that the increased demand generated from the economic recovery of the last five years demanded increased capacity from all the suppliers in the value chain as a whole, but due to cash constraints there

is yet not enough infrastructure to support this additional capacity demand. This is something that the managers also stated in KPMG (2012).

The second model on table 3, concerns the CCC metric to the firm performance on the value chain level. CCC is found to be on average significantly and positively related to the firm performance of the value chain. The relationship is also substantial, at the 1% significance level. Moreover, in table 4 the multi-group analysis concerning CCC vs firm performance reveals no association for the Retailers, OEM, Tier 1 and Tier 2 stage. On the contrary the CCC metric is significant for the Tier 3 stage and positively related to firm performance individually for that stage. Under the light, of these findings, support for Proposition 1 is mixed. The practical implication of this finding is that collaborative management of all the CCC components which comprise the CCC Metric, is mostly meaningful if is done at the value chain level with aggregated information and collaborative strategies. The supply-chain perspective (Hoffman & Kotzab, 2010) is in line with this result.

Table 4 CCC Coefficients by Tier Stages

Parameters	**Tier 3 (St. Error)**	**Tier 2 (St. Error)**	**Tier 1 (St. Error)**	**OEM (St. Error)**	**Dealers (St.Err.)**
(Intercept)	-127.517** (48.9)	-98.144**(35.1)	-50.151 (38.68)	6.261 (10.92)	-50.151 (38.680)
CCC	0.002** (0.001)	0.002 (0.002)	0.003 (0.002)	0.000 (0.0002)	0.03 (0.024)
DEBT	0.392 (0.244)	-0.221 (0.263)	1.991*** (0.784)	-0.084 (0.0487)	1.991 (0.7836)
Ln(Sales)	-0.033** (0.016)	-0.094*** (0.02)	-0.322 (0.082)	-0.1***(0.0220)	-0.322 (0.0824)
Years	0.064** (0.023)	0.049** (0.0174)	0.026 (0.019)	-0.002 (0.0053)	0.026 (0.0191)
QIC (fit stat.)	100.849	346.767	82.378	18.704	82.378

Table 4 shows the results on the Cash-to-cash cycle model (2) for each individual value chain stage.
**p<0.1 (10 % significance), **p<0.05 (5% significance), ***p<0.01(1% significance)*

CCC Components Multi-Group Analysis

In Table 5 the multi-group analysis of the separate value chain stages is presented. The (1) model was applied for each stage separately and tested the CCC components concerning that stage. According to the results, DIO is positively and significantly associated with firm performance in tier one, tier two but not the OEM firm. This is an interesting finding which suggests that maybe the tier one and two firms are having the most trouble to match inventory (production) capacity with demand. Interestingly tier three stage follows the traditional lean theory CCC-performance link and if combined with the tier three result of CCC in table four raises the question whether the supply integration (Hoffman & Kotzab, 2010) ends at tier two or if supply chain integration is even the defining parameter for it. For what is worth, managers even today strive for full supply chain visibility (>tier three) with limited success, a development that might explain why the results of tier three are connected with the single-perspective approach. Despite this ambiguity, the link between longer cycles of inventory with better performance in the automotive value chain seems to be robust.

The landscape is a bit different in the trade credit metrics (DSO, DPO). For DSO purposes, one can observe negative associations in the upstream part of the automotive value chain while positive and significant associations with firm performance can be observed for DPO for the same tiers. This could mean that DSO and DPO are very important for the upstream tier stages due to the thin profit margins that they operate with. Further evidence, towards the preferable of the collaborative WCM is that the OEM's DPO is negatively associated with firm performance as any abuse of power in that extend could harm the company itself due transfer pricing of any damage to its suppliers.

On the other hand, relationships in the last stage of the value chain (dealers) show that the only important metric to manage is the DSO. This is to be expected as at this stage, as firms are heavily involved with customer payment terms and leasing options from several enterprises. Thus, more days of sales receivables translate to more sold cars, due to better payment terms given to the customers.

Table 5 CCC Components by Value Chain Stage

Parameters	**Tier 3**	**Tier 2**	**Tier 1**	**OEM**	**Dealers**
(Intercept)	-769.503** (311.6)	158.039** (80.001)	-65.839*** (18.97)	-4.550 (9.26)	-37.983 (39.306)
DIO	-0.01** (0.046)	0.005*** (0.0002)	0.004*** (0.0011)	0.02 (0.011)	0.01 (0.027)
DSO	-0.002 (0.002)	-0.015*** (0.0004)	0.007* (0.0029)	0.000** (0.0002)	0.011***(0.037)
DPO	0.011*** (0.005)	0.005*** (0.0001)	0.000 (0.019)	-0.003***(0.001)	-0.02 (0.002)
DEBT	1.547*** (0.277)	-0.564*** (0.1178)	0.142 (0.19)	-0.170* (0.09)	2.146 (0.871)
Ln(Sales)	-0.061*** (0.016)	-0.279*** (0.0290)	0.026 (0.020)	-0.143***(0.02)	-0.253***(0.09)
Years	0.383*** (0.155)	-0.077* (0.0396)	0.033*** (0.0094)	0.003 (0.0045)	0.02 (0.019)
QIC(fit stat.)	40.405	16.729	33.052	19.733	88.809

Table 5 shows the results on the CCC Components model (1) for each individual value chain stage.
*p<0.1 (10 % significance), **p<0.05 (5% significance), ***p<0.01(1% significance)

Conclusion, Limitations and Future Research

This paper contributes to the literature of WCM with a comprehensive research of the automotive value chain. By using a repeated-measures data panel and General Estimating Equations, the link between the cash-conversion-cycle components and firm performance was examined. The data set robustness and representativeness were enhanced through the utilization of real documented supply chain relationships and thus an uncritical estimation of the relationships was avoided. The results were interpreted with the help of the emerging theory of financial supply chain management, the discussion for collaborative WCM practices and Transaction Cost Economics.

The theoretical conjectures of the collaborative WCM theory as described before, appear to be in-line with our findings. More specifically, the results of our research contradict previous conventional knowledge on WCM and suggest that in the automotive industry longer inventory cycles lead to better firm performance. This finding further gives credibility to the "industry-specific leanness" school of thought which has recently emerged and certainly challenge traditional literature by hinting at a deeper and more complicated relationship between the production cycles lengths and DIO. Moreover, a negative link between trade credit components (DSO, DPO) and firm performance was identified in the value chain level, suggesting that the automotive industry managers now follow a more supply chain approach and understand that single stage optimization gives short-term gains which are cancelled out from the other stages. Despite these results, conclusive judgement for collaborative WCM is premature but our findings lay the foundation for more value chain research in this topic.

A significant limitation for our research is the lack of theory to explain the variations of the CCC component coefficients between tiers. These variations hint that maybe each tier characteristics affect differently the optimal relationship between the firm performances in that tier and the respective CCC components. This notion for 'stage-specific' relationships should be explored further in future research. Moreover, it would be interesting to examine cross-tiers interaction or in other words how CCC metric changes in one tier could affect firm performance of their buyer (downstream tier) and under what conditions.

Lastly, despite the robustness of our Dataset due to the FACTSET database, the sample size and demographics is limiting the results' generalizability. An interesting future research would be the replication of this study with larger data and alternative value chain designs in order to establish the validity of the results. Finally, the use of Tobin Q poses another limitation towards conclusive results. Although, Tobin's Q is compatible with inventory replenishment operations, future research endeavors should replicate this study with an alternative firm performance metric, known for its compatibility with operation processes.

Conclusively, the findings of this paper suggest the existence of collaborative working capital practices and as the automotive industry supply chain integration gets stronger, these practices will become a necessity to reduce transaction costs.

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Supplier contribution to buyer innovativeness: the influence of customer attractiveness and strategic fit

Nico D.A. Steenstra[a]

Cees J. Gelderman[b]

Jos M.C. Schijns[c]

Janjaap Semeijn[d]

[a] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31566650409, e-mail nico.steenstra@ou.nl

[b] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762590, e-mail kees.gelderman@ou.nl

[c] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762196, e-mail jos.schijns@ou.nl

[d] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762588, e-mail: janjaap.semeijn@ou.nl

Abstract

Buying companies increasingly need suppliers that substantially contribute to their innovation and capability resources. Customer attractiveness and the strategic fit with a supplier are likely to play an important role in new product development projects. However, no research has addressed and simultaneously investigated the interplay of strategic fit, customer attractiveness, and supplier contribution to buyer innovativeness. This study fills this gap by carrying out a quantitative survey study among 81 members of the branch organization for the Dutch fabricated metal industry. The findings largely confirm the positive relations between the core variables of this study. The results suggest that purchasing professionals should invest in customer attractiveness, rather than coerce business partners into supplier development programs.

Key Words: buyer-supplier relationships, buyer innovativeness, strategic fit, customer attractiveness

Category: competitive paper (IPSERA 2018)

1 Introduction

Increasing global market competition, fast changing customer demands and the environmental uncertainty and complexity require continuous development of products and services (Ferreira, Fernandes, Alves, & Raposo, 2015; Kibbeling, der Bij, & Weele, 2013; Revilla & Villena, 2012). Therefore, innovation is imperative for firms to gain sustainable competitive advantage (Arlbjørn & Paulraj, 2013). Innovation and innovation management have been a popular research topic for many decades. In addition, the issue of how inter-firm collaboration creates and stimulates innovation performance has become a critical research question (cf. Song et al., 2010). Gone are the days when innovations were the result of the efforts put forth within a single firm; instead, firms need to increasingly rely on the competencies of multiplicity of firms within their supply chain network in order to innovate (Arlbjørn & Paulraj, 2013). By teaming up with other firms that have complementary resources, a company can make the most of its own resource base, without having to build up other resources from scratch.

In a strategic buyer-supplier relationship, the buyer (as well as the supplier) aims to leverage the relationship to gain competitive advantage (Tanskanen & Aminoff, 2015). Inter-firm collaboration has become a crucial component in the pursuit of competitive advantage (e.g. Nielsen, 2010), although strategic buyer-supplier relationships require much effort and are complex to manage successfully. Furthermore, collaboration on open innovation in supply chains (Rosell, 2014), and a trend towards reduction of suppliers in many business-to-business markets (Schiele et al., 2012) increase the exposure to potential opportunistic behaviour. Obviously, both buyers and suppliers have become very selective in terms of with whom to engage in a strategic relationship (e.g. Tanskanen & Aminoff, 2015). From an innovation perspective, buyers need suppliers that actually contribute to their innovation resources and capabilities. Companies are advised to select suppliers with complementary resources and skills (Wilkinson et al., 2005).

Obviously, not every supplier is capable of contributing to the innovativeness of the buying company. A critical purchasing task is to identify innovative suppliers with technical expertise in combination with a collaborative attitude which distinguishes suppliers that contribute to buyer innovativeness from suppliers that do not? (Pulles et al., 2014). The scarce literature sheds little light on this crucial issue. In order for a supplier to contribute to its customers' innovation processes, the supplier needs to be innovative, technically competent, and offer high quality products (e.g. Croom, 2001). The case study research of Schiele & Krummaker (2011) suggested that the suppliers that contributed most to buyer innovativeness are the ones that consider that buyer as a 'preferred customer'. Customer attractiveness becomes more important when suppliers are considered strategic or when suppliers have many alternatives. A strategic partnership with a supplier is preferred, when the contribution of that supplier affects critical processes, components or systems of the buyer (Hsuan, Skjott-Larsen, Kinra, & Kotzab, 2015).

Mortensen and Arlbjørn (2012) concluded that the performance and efficiency of the development initiative can be positively affected by the buyer when it considers the strategic

fit with the supplier. As an outcome of this research it is expected that a strategic fit positively influences the supplier contribution to buyer innovativeness. Furthermore a strategic fit can affect a supplier's perception of customer attractiveness (Mortensen et al., 2008) therefore a positive relationship between strategic fit and customer attractiveness should be a plausible finding. Since customer value is expected to rise in joint collaboration on innovation projects (La Rocca et al., 2012), it is expected that customer attractiveness positively influences supplier contribution to customer innovativeness.

Although the concept of customer attractiveness has received increasing attention in academic literature, few empirical studies investigate the influence of customer attractiveness on the actual contributions of suppliers to the innovativeness of buyers. Most studies do not particularly focus on the purpose of ways for buyers to be attractive (cf. Schiele et al., 2012), for instance to gain access to technologies and innovation initiatives of suppliers (e.g. Ellis et al., 2012). Few have addressed and investigated the interplay of the strategic fit between buyer and supplier, customer attractiveness, and supplier contribution to the innovativeness of buying companies. This study fills this gap through a quantitative study, addressing and simultaneously investigating the interplay of strategic fit, customer attractiveness, and supplier contribution to buyer innovativeness. A conceptual model was developed and empirically validated using data from a survey among the members of the branch organization for the Dutch fabricated metal industry.

This study contributes in several ways to the existing knowledge. First, where the traditional perspective is more focused on supplier attractiveness, a supplier's perspective on customer attractiveness might help to better understand the innovative contribution of suppliers (Schiele et al., 2012; Schiele & Vos, 2015). Second, most literature about customer attractiveness is either conceptual or based on case studies. This study is survey based, aimed at investigating specific antecedents of supplier contributions to buyer innovativeness (Hüttinger et al., 2014) . Third, this study examines the influence of the strategic fit between buyer and supplier on customer attractiveness and directly on supplier contribution to buyer innovativeness.

2 Theoretical background and hypotheses

2.1 Innovativeness of the buyer

Innovativeness refers to "a firm's ability to develop and implement new ideas, processes, or products in the organization" (Inemek & Matthyssens, 2013, p. 581). Innovativeness may also imply a firm's willingness to explore and invest in new opportunities (Garcia et al., 2003). Innovativeness is a multidimensional construct and product- and process innovation are the foremost dimensions (e.g. Phan, 2013; Salomo, Talke, & Strecker, 2008; Tidd, Bessant, & Pavitt, 2005). Phan (2013) concludes that both product and process innovation emerge as interconnected issues and there exists only a blurred dividing line. Product innovativeness is considered as a measure of the potential discontinuity a product can generate in the marketing and/or technological process. In our study we will follow Garcia and Calantone (2002) who consider technological innovation as an iterative process leading to the successful production and marketing of that innovation. An innovation is only of economic value when the New Product Development (NPD) process leads to a successful market introduction (Schumpeter,

1934). The iterative aspect implies that innovation takes place at the development stage, but also at all subsequent phases in the product life cycle, including manufacturing, installation, consumption, and maintenance (Martini, Laugen, Gastaldi, & Corso, 2013).

With Cohen and Levinthal (1990), we consider the capacity to innovate as the organization's ability to successfully adopt or implement new ideas, processes or products. Buyer innovativeness appears from the fact that the buyer often leads the industry at introducing new products and adapting new technologies (e.g. Song et al., 2010). Firms with more internally developed research capabilities benefit more from collaborations, and firms with more collaborations benefit more from their internal basic research (Fabrizio, 2009). The accrual of knowledge assets that drive innovation in firms come from two primary sources: internal knowledge generation and knowledge derived from external sources (Bellamy, Ghosh, & Hora, 2014). By evaluating and finally selecting suppliers, the purchasing function has a strong influence on the innovation performance of the firm (Corsten & Felde, 2005).

2.2 Supplier contributions to buyer innovativeness

In the 90's Roberts (2001) found that the most important change in technology management over the past decade is the relentless intensification of all companies dependence upon external sources of technology. In multilevel business-to-business relationships, suppliers often have the best or the only access and comprehensive knowledge about the end users and are considered as an important resource (Brem & Tidd, 2012). The ability to protect a resource barrier and to maintain a relative position to competitors indicates a potential for high returns, since one competitor will have an advantage (Wernerfelt, 1984). Innovative suppliers can function as a first mover advantage.

Supplier contribution is not limited to product offerings but also encompasses resources such as information about the supplier's product, its product application, how to process the supplier's product, the supplier's IT and logistics services, and especially the supplier's information that will help the buyer create value in the relationship and in its other relationships such as with its own customers (Baxter, 2012). Furthermore, suppliers may contribute to firm innovation by performing R&D of its own and thus absorbing some of the R&D costs the buying firm would have to incur normally. Moreover, suppliers may have valuable knowledge of production and fulfilment processes that may influence firm performance. Finally, suppliers can transfer ideas for better products and features that could enable the buying firm to enhance products itself (Corsten & Felde, 2005).

Inter-firm collaboration has become strategically important for companies that need to strengthen their innovation capabilities (Pulles et al., 2014). A strategic mode of collaboration focuses on sharing customer requirements, basic technology exchange, new product development, new market entry and capital expenditure planning (Cousins, 2005). Although costs and quality of products remain important aspects within global competition, real competitive advantage is to be found in a firm's ability to mobilize complementary resources, adapt routines and foster competencies in order to survive (Heine & Rindfleisch, 2013; Prahalad & Hamel, 1990; Stieglitz & Heine, 2007). Suppliers should therefore contribute with

complementary capabilities such as a high level of innovativeness and fitting learning styles (Azadegan & Dooley, 2010).

Buyer-supplier collaborations are important sources of innovation (Walter et al., 2001). Supplier contributions to the innovativeness of buyers can be considered as the outcome of collaborative behaviour (Krause, Pagell, & Curkovic, 2001). The collaborative behaviour of suppliers is reflected by their pro-activeness in approaching the buyer with innovative ideas, the actual support in product development and process improvement, and the willingness to share (technological) information (Pulles, Veldman, & Schiele, 2014). Prior research suggests that collaboration in product development results in significant improvements in the product development performance of the buyer, in terms of cost, quality, cycle time, and innovation (e.g. Inemek & Matthyssens, 2013). It is proposed that greater depth of supplier involvement across the stages of the NPD cycle will lower the causal ambiguity experienced by inter-organizational NPD teams (Potter & Lawson, 2013). The supplier contribution to NPD is to a large extent influenced by the degree of attractiveness of the buyer (cf. Schiele & Vos, 2015). Therefore, we hypothesize:

H_1: *Supplier contribution to buyer innovation is positively related to buyer innovativeness.*

2.3 Customer attractiveness and supplier contributions

Attraction is a concept from the Social Exchange Theory and explains how social relationships initiate, endure and develop (e.g. Blau, 1964; Christiansen & Maltz, 2002; Ellegaard & Ritter, 2006). Business relationships can be assessed in terms of benefits and costs. This means that the relationship continues as long as the partner is sufficiently attractive and adds value to the relationship. Two broad approaches to customer attractiveness emerge from existing literature (La Rocca et al., 2012) . The first is related to the current and potential economic value of the customer to the supplier. According to Walter et al. (2001) this economic value is the result of direct monetary benefits from the customer realized through its profit, volume and safeguard function. Baxter (2012) proved that supplier's commitment to the buyer is strongly related to customer's financial performance as judged by the supplier. The second is the relational focus which encompasses factors that are related to the characteristics of the relationship and customer supplier fit. In this stream of literature, the customer attractiveness to a supplier refers to "the buyer's interaction strategy that aims to increase supplier dedication to the buyer in relation to the supplier's other customers" (Makkonen et al, 2016, p. 157). Ellegaard and Ritter (2006) argue that an attractive customer is better at mobilizing supplier resources, leading to increased added value. Walter et al. (2001) link relational aspects to indirect non-monetary benefits for the supplier. These benefits can be realized through the customer by its innovation function, its market function, its scout function and its access function. The way a customer deals with a supplier in an ongoing relationship clearly affects the willingness and opportunities of that supplier to participate in a particular development project (Wynstra, Weggeman, & Van Weele, 2003). Attractive customers collaborate with suppliers in order to leverage core competencies and acquiring knowledge of new technology (Christiansen & Maltz, 2002; Walter et al., 2001).

Customer attractiveness means that the buyer should be sufficiently attractive to the supplier, whereby the latter will not abuse its power and will provide privileged resource access (Schiele & Vos, 2015) which leads to loyalty and superior performance (La Rocca et al., 2012). The main goal of being an attractive customer is to achieve preferred customer status (Baxter, 2012) where the supplier offers the customer prioritized access to their technology and innovations (Ellis et al., 2012; Steinle & Schiele, 2008). Therefore being an attractive customer is an important condition in order to consistently receive competitive preference for scarce resources from a critical mass of suppliers (Bew, 2007). Attractive customers collaborate with suppliers to leverage core competencies and acquiring knowledge of new technology (Christiansen & Maltz, 2002; Walter et al., 2001).

H_2: Customer attractiveness is positively related to the supplier contribution to buyer innovativeness.

2.4 Strategic fit between buyer and supplier

Strategy literature discusses the concept of strategic fit on the organizational level (cf. Hong et al., 2011). Companies are advised to align the basic set-up of the firm with the characteristics of the environment (cf. De Wit & Meyer, 2010). Strategic changes are pursued to remain in harmony with external conditions. Adapting strategic fit in order to optimize organizational performance can cause a potential tension between a firm's strategy and its environmental situation vs. a fit between its strategy and its unique competencies (Zajac, Kraatz, & Bresser, 2000). This tension increases when environmental situations require adaption of strategy and affecting the traditional core competencies (Prahalad & Hamel, 1990).

Strategic fit has also been used as a key concept to investigate a variety of topics and issues, for instance supply chain management (consistencies between a product and its underlying supply chain, cf. Wager et al., 2012), project management (consistencies between project environment, project resources, and project goals, cf. Hong et al., 2011), alliances (consistencies between the motives of both partners, cf. Nielsen, 2010), and innovation management (consistencies between existing resources and new product development projects, cf. Harmancoglu et al., 2009). In addition, within the context of inter-organizational collaboration, a strategic fit refers to similarities between the supplier and buyer in terms of similar background, prior history, strategy, attitudes, complementary skills, and reputation (Mortensen & Arlbjørn, 2012). Organizations tend to prefer partners with complementary resources and skills, but who operate in similar ways in similar market positions (cf. Wilkinson et al., 2005). Buyers and suppliers with a high level of strategic fit are likely to share a common understanding of the relationship value and a common perception of attractiveness (cf. Mortensen & Arlbjørn, 2012). In general, positive benefits and outcomes are associated with a strategic fit between collaborating organizations. The strategic fit between business partners is likely to facilitate and stimulate the contributions of suppliers to the innovativeness of the buyer. We hypothesize:

H_3: The strategic fit between buyer and supplier is positively related to the supplier contribution to buyer innovativeness.

Suppliers are more likely to be responsive to buyers whose expenditure constitutes a greater rather than a smaller proportion of their total sales. Ramsay and Wagner (2009) identified several other sources of value for suppliers. Also, demand stability and forecast reliability, both aspects of strategy fit, are related to customer attractiveness. If markets are highly unstable suppliers may seek a secure stream of relatively unprofitable deals as an insurance against unforeseen demand failures (Walter et al., 2001). Especially for manufacturers which lack size or power to force suppliers to share leading edge technology, exchange of innovation and market information can be valuable sources for a supplier. Transferring knowledge, training supplier's personnel, participation in customer's processes or open information exchange systems can turn a small customer into an attractive partner (Christiansen & Maltz, 2002). Suppliers, particularly in fast changing, technologically complex product sectors, may regard early involvement in the customers R&D processes as essential for securing future orders (Ramsay & Wagner, 2009). In case of a high level of strategic fit, customers are likely to be perceived as attractive business partners. The perception of attractiveness will be affected by the strategic fit between buyers and suppliers (Mortensen & Arlbjørn, 2012). We posit:

H_4: The strategic fit between buyer and supplier is positively related to the customer attractiveness.

Figure 1 shows the conceptual model.

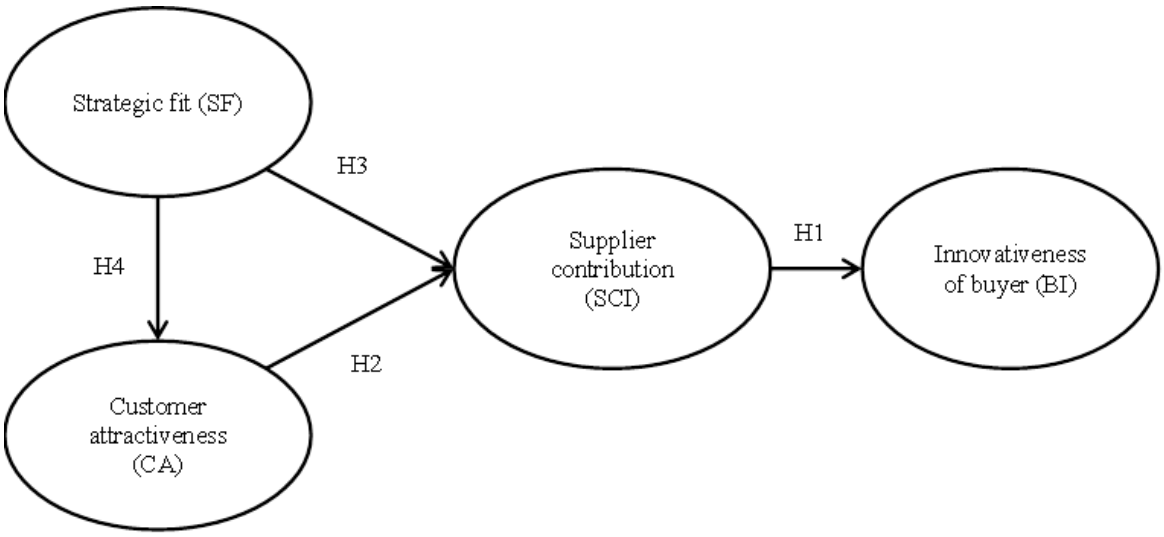

Figure 1: Conceptual model

3 Research method

The hypotheses were tested using a survey administered to the 1,600 members of the branch organization for the Dutch fabricated metal industry (northern district). Data were collected through an online questionnaire, which was brought to attention via the weekly newsletter. In

addition, members were asked to fill in the questionnaire in a meeting. An important selection criterion was that respondents should actively be involved in innovative cooperation with customers. A total number of 83 questionnaires was received, resulting in an effective response rate of 5.2%. We used structural equation modeling to test the plausibility of our causal model. The advantage of this method compared to regression is that it allows analyzing a system of variables at once. We specifically decided to use the variance-based PLS-SEM approach. This multivariate analysis is compared to the covariance-based SEM less stringent when working with non-normal data, achieves higher statistical power even with small sample sizes and is the recommended method when working with reflective constructs (Hair et al., 2017).

About 73% of the respondents have executive as their job title. The other respondents were sales manager (12%), production manager (11%), procurement manager (2%) and R&D manager (1%). Member companies of the branch organization are all small and medium sized companies (SMEs). 83% of the participating companies were industrial production companies, 4% were trading companies and 13% were service companies. 76% of the companies have fewer than 50 employees, 22% fewer than 250 employees. Looking at the areas of responsibility it can be assumed that respondents are involved in innovative cooperation with customers.

The variables in the hypotheses were measured as multiple-item constructs on 5-point Likert-scales. Operationalizations were derived from measurement scales used in other academic studies. Respondents were asked to keep in mind one of their most important customers. The *buyer innovativeness* was measured using five items drawn from Imenek & Matthyssens (2013). We adapted items that were used by Inemek & Matthysens (2013) in their operationalization of a supplier innovativeness construct. Items measure ‘adopting new technologies’ and ‘asking for new products and investments’ and ‘approaching suppliers for joint product development’. The *supplier contribution* construct was based on the operationalization of Pulles et al. (2014). The seven items reflect the willingness to share information (attitude) and the actual involvement in collaborative ventures (behavior). The items measure predominantly the collaboration with the customer in a number of areas (i.e. product quality, technical assistance, innovation workshops, information sharing, and ventures). A strategic fit between companies is likely to affect the common understanding of the relationship value and is likely to stimulate suppliers to contribute to buyer innovativeness. Buyers need suppliers with complementary resources, but prefer partners who operate in similar ways. The items to measure the *strategic fit* ask respondents to compare ‘their’ customer to other customers. Five items, adapted from Mortensen & Arlbjørn (2012), were used to measure the strategic fit construct. Customer attractiveness can help to attain preferential access to supplier resources that are important sources of innovation. The *customer attractiveness* construct is measured by five items obtained from Pulles et al. (2015). The questionnaire was pretested to improve readability, question order and to improve ambiguous questions.

4 Results

4.1 Evaluation of measurement models

- Examining Indicator Loadings

A common rule of thumb is that outer loadings below 0.70 should be considered for removal but should be deleted only when deleting the indicator leads to an increase in the composite reliability (CR) and/or average variance extracted (AVE) above the suggested threshold values of 0.70 and 0.50 respectively (Hair et al., 2017; see next sections). As a result, five out of 22 reflective items were dropped because of poor outer loadings. In the sections that follow, the results of the final model are presented and interpreted.

- Assessing Reliability

The most commonly used measure of reliability is the internal consistency reliability. Composite reliability (CR) and Cronbach's alpha are both measures of internal consistency reliability. For exploratory research, Cronbach's alpha values greater than about 0.60 are acceptable (Bagozzi, 1994). CR values from around 0.70 represent acceptable reliability, although this is not an absolute standard, and values below 0.70 are acceptable if the research is exploratory in nature (Hair et al., 1995). In our study, both Cronbach's alpha values and CR values meet the threshold values of 0.60 and 0.70 respectively, suggesting that internal consistency reliability of each reflective latent variable is acceptable.

- Assessing Validity

The dominant measure of convergent validity is the Average Variance Extracted (AVE). AVE should be 0.50 or higher (Hair et al., 2017). In our study, all AVE values are above 0.50, suggesting that convergent validity of each latent factor is acceptable. Another measure of convergent validity of the measurement models is found by computing the standardized loadings for indicators and generating Bootstrap t-statistics for their significance. "At a minimum, the outer loadings of all indicators should be statistically significant." (Hair et al., 2017: 113). In our study all standardized loadings are found significant at a significance level of 0.001, confirming convergent validity.

To determine the discriminant validity of our indicators, we checked the matrix of loadings and cross-loadings for all reflective items in the model. "The loadings of the items in this table should be greater for the latent variable to which they theoretically belong than for any other latent variable" (Lowry and Gaskin, 2014: Table A1.2). There is no presence of cross loadings that exceed the indicators' outer loadings. Thus, there is considerable indication that discriminant validity is met. Criterion for assessing discriminant validity is the Heterotrait-monotrait ratio of correlations (HTMT) (Henseler, Ringle, & Sarstedt, 2015). Gold et al. (2001) and Teo et al. (2008) suggest that if the HTMT value is below 0.90.

Table 1: Heterotrait-Monotrait Ratio (HTMT)

	Customer attractiveness (CA)	Innovativeness of buyer (BI)	Strategic Fit (SF)
Innovativeness of buyer (BI)	0.437		
Strategic fit (SF)	0.541	0.459	
Supplier contributions (SCI)	0.767	0.669	0.538

4.2 Evaluation of the structural model

Collinearity assessment

o assess collinearity, we consider variance inflation factor (VIF) values above 5 in the predictor constructs as indicative of a potential collinearity problem (Hair et al., 2011). As can be concluded from Table 2, VIF values in our study are well below the threshold value of 5, indicating that collinearity is not an issue.

Table 2: Collinearity Assessment

First set (CA)		**Second set (SCI)**		**Third set (BI)**	
Construct	VIF	Constructs	VIF	Construct	VIF
SF	1.000	SF CA	1.190 1.190	SCI	1.000

Size and significance of path coefficients

Table 3 presents the estimates of path coefficients of the proposed model and respective t-values and levels of significance. All hypothesized paths are statistically significant.

Table 3: Size and significance of the Structural Model Path Coefficients

Path	**Path Coefficients**	***t* Values**	**Sign. Levels**	***p* Values**
Customer attractiveness (CA) -> Supplier contributions (SCI)	0.449	4.491	***	0.000
Strategic fit (SF) -> Customer Attractiveness (CA)	0.400	4.089	***	0.000
Strategic fit (SF) -> Supplier contributions (SCI)	0.248	2.773	**	0.006
Supplier contributions (SCI) -> Innovativeness of buyer (BI)	0.571	8.102	***	0.000

Note: $^{**}p \leq 0.010$; $^{***}p \leq 0.001$

Figure 2 shows the structural model including the size and significance of path coefficients, as well as R^2 values.

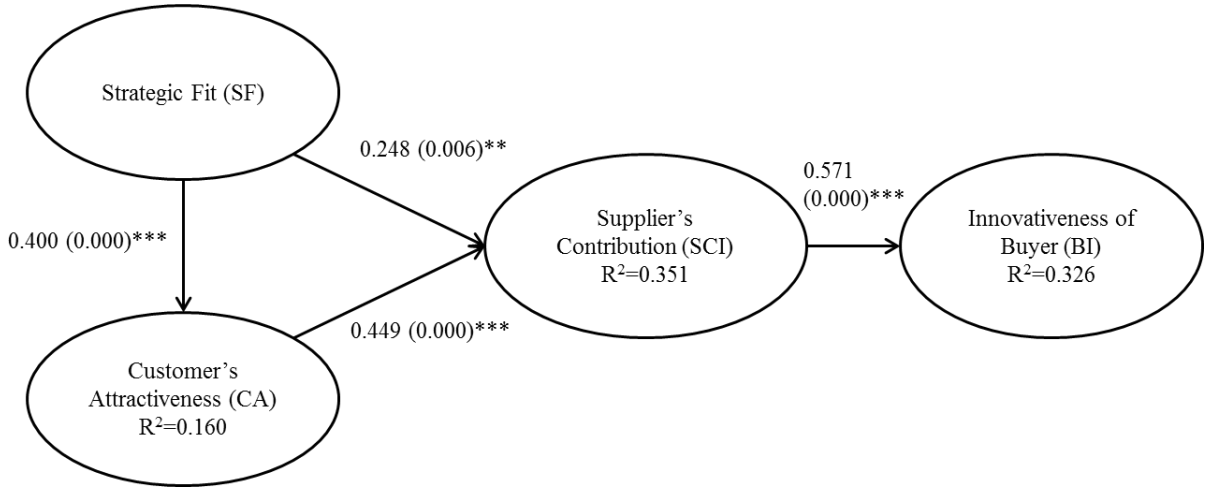

Figure 2: Structural model including the size and significance of path coefficients and R^2 values

5 Conclusions and discussion

Innovation is imperative for many organizations to maintain competitive advantage. The critical importance of collaborative supplier relationships is well documented and sustained in literature. In New Product Development processes, where supplier and buyer work closely together, mutual trust, commitment and understanding are important relational characteristics that reduce risks and potential opportunistic behaviors. A strategic fit between buyers and suppliers is likely to have a positive impact on the buyer-supplier collaboration. A relative new topic is customer attractiveness which relates to the need for buyers to achieve preferred customer status and to gain access to scarce, often technological, sources of innovative suppliers. However, no research has addressed and investigated the interplay of the strategic fit, customer attractiveness and supplier contribution to buyer innovativeness. This study was aimed at filling this gap by analyzing data from members of the branch organization for the Dutch fabricated metal industry.

The results of our study confirm the positive relationship between buyer innovativeness and collaborative behaviors of supplier (H_1). As expected, supplier contributions are an important source of innovation for buying companies (cf. Walter et al., 2001). Valuable suppliers proactively approach their customers with new ideas and actual support in product and process improvement (cf. Pulles et al., 2014). With Ellis et al. (2012), we show that a productive supplier's involvement in a buying firm's new product development process is positively related to the supplier's perception of the buying firm as a preferred customer which, in turn, is positively associated with the willingness to share new technology with the buyer. These positive perceptions of customer attractiveness can be considered an important

antecedent for successful supplier integration into collaborative NPD projects (cf. Schiele, 2012; Schiele et al., 2012).

Although a growing number of studies includes customer attractiveness as an important concept for understanding buyer-supplier relationships, few empirical studies investigated the influence on the actual contributions of suppliers to the innovation of their customers. We find a statistically significant relationship between customer attractiveness and supplier contribution (H_2), which is in line with the results of prior research (cf. Schiele et al., 2012; Ellegaard & Ritter, 2006; Christiansen & Maltz, 2002).

The empirical results shed light on the role of the strategic fit between buyer and supplier in the supplier contribution to buyer innovativeness. Similarities between parties is likely to facilitate and stimulate buyer-supplier collaboration. However, the impact and the role of the strategic fit between buyers and suppliers appears to be an overlooked factor in buyer-supplier research, with Mortensen & Arlbjørn (2012) as a notable exception. There must be more to the business relationship than suppliers "merely" providing valuable and complementary resources and skills (Wilkingson et al., 2005). We developed hypotheses that relates the strategic fit with the supplier contributions (H_3) as well as with customer attractiveness (H_4). The empirical results provide support for theoretical expectations. This paper is the first to empirically investigate and confirm the relationships between the strategic fit, customer attractiveness, and supplier contribution to buyer innovativeness.

6 Limitations and recommendations

This study had a number of limitations, which could induce further research. The sample was restricted to supplying companies in the fabricated metal industry. To get more insights into the effects of customer attractiveness and strategic fit, future research could use a dyadic approach and include the experience and views of both buyers and suppliers. Another limiting aspect is the cross sectional nature of this study. Experimental and longitudinal studies would be more suitable for investigating cause-effect relationships, shedding light on the interplay of the various variables under study.

Suppliers can contribute to various levels and types of innovativeness such as to architectural or to component innovations (Garcia & Calantone, 2002; Lee & Veloso, 2008). The level and type of innovativeness impact the intensity of knowledge transfer, interaction and the level of interdependency between buyers and suppliers (Sobrero & Roberts, 2002). Because the level of interdependency differs with the level and type of innovativeness, future research into the role of strategic fit at the various levels and types of innovativeness could lead to better insight in collaborative NPD projects.

Another avenue of future research could be including drivers for customer attractiveness. Tanskanen & Aminoff (2015) distinguished economic-based, behavioral-based, resource-based, and bridging-based drivers of attractiveness. Different drivers could play different roles in collaborative buyer-supplier relationships in general, and in buyer innovation initiatives in particular. Similar to strategic fit, the concept of customer attractiveness too can be considered at different levels. Our study implicitly employed the meso-level: between companies. Other

levels that could be investigated are the micro-level (between individual actors) and the macro-level (entire networks and supply chains). Each level could produce other explanatory power in analyzing supplier contributions to the innovativeness of buying companies (cf. Schiele et al., 2012).

The results of our study suggest that purchasing professionals could benefit from the finding that a strategic fit with supplying companies significantly enhances the impact of supplier contribution to innovation projects. Buyers should acknowledge the need to develop and implement (marketing) strategies aimed at improving their (perceived) attractiveness for innovative suppliers. Buying companies should redesign supplier development programs which are aimed at forcing suppliers to improve their performance. A more mature and promising approach for buyers is to invest in their own customer attractiveness.

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Comparing Purchasing and Supply Management Job Advisements in Europe and Confucian Chinese Society

Klaas Stek*[12] klaas.stek@utwente.nl / klaas.stek@tugraz.at
Haoqing Zhang[1] h.zhang@student.utwente.nl
Volker Koch[2] volker.koch@tugraz.at
Bernd Markus Zunk[2] bernd.zunk@tugraz.at
Holger Schiele[1] h.schiele@utwente.nl

[1] University of Twente, School of Behavioural, Management and Social Sciences, Department of Technology Management & Supply, Drienerlolaan 5, 7522 NB Enschede - The Netherlands

[2] Graz University of Technology, Institute of Business Economics and Industrial Sociology Working Group „Industrial Marketing, Purchasing and Supply Management “, Kopernikusgasse 24/II, 8010 Graz – Austria

*corresponding author, contact by e-mail or +31629225498

Summary
This research aims to reveal the common grounds and the cultural and structural induced differences in a set of 300 European and 300 ‘Chinese’ job advertisements (China, Hong Kong and Singapore). European and ‘Chinese’ employers require both hard and soft skills, however more soft skills than hard skills are demanded. From the about 60 skills one third is a common ground, one third is typically Chinese and one third European. Negotiation is the highest ranked common ground. The paper emphasises on the managerial implications for companies with a multicultural Chinese and European staff in PSM.

Keywords: job skills, PSM, Confucian Dynamism

Submission category: Working paper

Introduction

Purchasing and supply management (PSM) professionals are frequently working in a global business context (Horn et al., 2013). Understanding cultural differences can help professionals to communicate appropriately with people from different cultural backgrounds (Hofstede et al., 2010). Successful use of cross-cultural teams could provide different insights into the inner and outer world and avoid cultural misunderstandings to achieve the competitive position of organizations in a global setting (Dafoulas and Macaulay, 2002).

The impact of national cultures on the success of operations practices and firms’ performance in certain countries is significant (Chipulu et al., 2014; Hope and Mühlemann, 2001; Shou and Wang, 2017; Wiengarten et al., 2016). Differences in operational decision-making can be explained by deviations in the rise of cross-cultural issues (Pagell et al., 2005) and national culture is a key factor that is influencing PSM performance (Quintens et al., 2005; Shou and Wang, 2017). With the increasing economic globalisation, many Europe-based multinational companies integrated themselves into global sourcing and a majority of them are targeting the Asian market (Horn et al., 2013). The PSM functions in European firms have been

more global and interconnected in the Asian market, by offshoring to countries like China, Hong Kong and Singapore. However, not all offshoring lead to success. Partly due to cultural issues firms restored to European suppliers (Horn et al., 2013). This study aims to explore differences in PSM job advertisements between 'Europe' (Austria, Belgium & the Netherlands) and 'Confucian Chinese Society' (China, Hong Kong and Singapore).

For this research, a bi-continental approach is chosen, to compare online PSM job advertisements from 'Europe' with 'China'. The European sample was already drawn in an earlier research from online job platforms in three European countries with an alike GDP per capita, but with distinctive different cultural profiles: Austria, Belgium and the Netherlands (Hofstede et al., 2010; Kale, 1995; Kogut and Singh, 1988; Stek et al., 2017). The Chinese societies sample is an exact replication of the European set and is drawn from online job platforms in the Peoples Republic of China, Hong Kong and Singapore. To distinct the national cultural differences the four cultural dimensions of Hofstede are applied (Batenburg, 2007; Hofstede et al., 2010).

Literature sees the secondary data analysis, like requirements mentioned in online job advertisements, as an important source of state-of-the-art and practical available data that gives good understanding what employers' requirements are (Arcodia and Barker, 2003; Mathews and Redman, 2001; Rafaeli and Oliver, 1998; Shou and Wang, 2017). This research will eventually contribute to literature as the first to compare PSM (or SCM) job ads between the two continents with the aim to find common grounds and the cultural and structural induced differences.

Literature review

Affiliates of western companies in Asian countries are actively involved with the parent companies' global procurement activities and are *'duplicating the sourcing strategies with suppliers in Asia that have been used successfully by their parent company'* (Carr et al., 2000). As the technology and the nature of supply markets is fast changing, the role of the purchasing function has changed. The PSM function *'evolved from a loose affiliation among functions such as purchasing, manufacturing, and logistics to an integrated and cross-functional discipline'* (Radovilsky and Hegde, 2012). PSM professionals are more and more responsible global sourcing and have to deal with *'longer and more complex supply chains, longer time of purchasing and in essence more severe competition and challenges'* (Shou and Wang, 2017),

Firms require market, product and technical knowledge (Bruneel et al., 2010; Eriksson et al., 1997). In addition, scholars believe that value of market knowledge will be extended by providing employees and managers, who have strong entrepreneurial spirit, with training programs that enhance their ability to apply market knowledge (Ma and Huang, 2016). Additionally, the literature suggests that having the necessary skills to interpret changes in the supplier market, offer technical assistance and assist in developing suppliers are some of the necessary skills for strategic purchasing (Eltantawy et al., 2009; Knight et al., 2014; Steinle and Schiele, 2008).

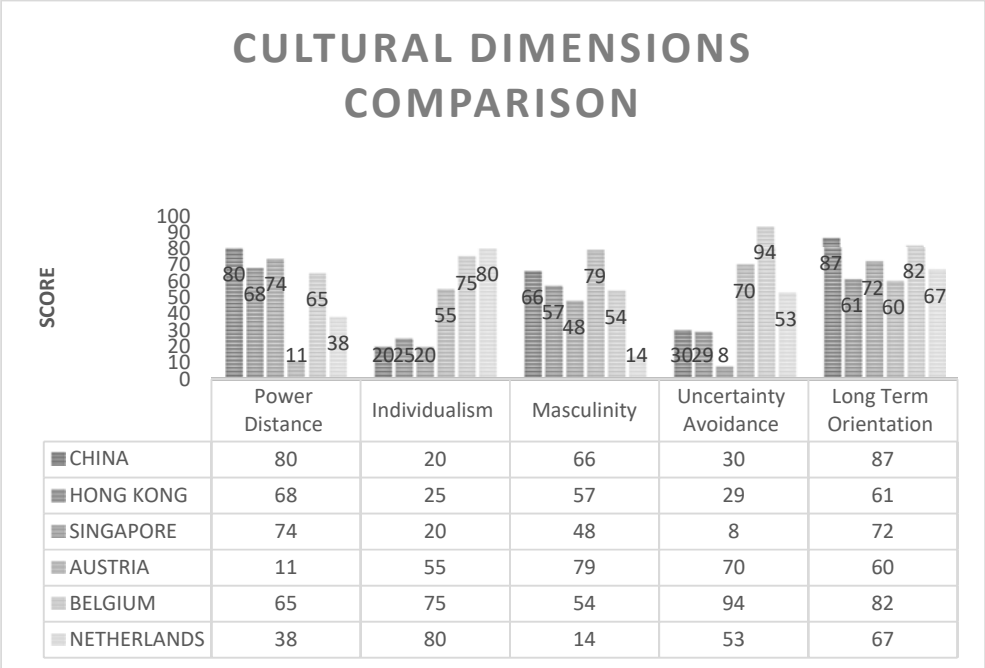
The Confucian Dynamism Dimension

In his book *Culture's Consequences* Hofstede concluded his study with an extensive research of employees from culturally diverse backgrounds at the international corporation IBM (Hofstede, 1984). In addition, he divided national cultural variabilities into four dimensions, including power distance, uncertainty avoidance, individualism, and masculinity. Based on a questionnaire designed by Chinese scholars (Hofstede and Bond, 1988), scholars have argued that there is Confucian Work Dynamism, which is identified in Asian countries and strongly correlated with recent economic growth (Hofstede and Bond, 1988). Hofstede defined the fifth dimension as "Confucian Dynamism" (also known as the fifth cultural dimension 'Long-term

orientation') in his later work in 1991. In the second edition of *Culture's Consequences*, this new finding is discussed extensively. *'Values associated with long-term orientation are thrift and perseverance; values associated with short-term orientation are respect for tradition, fulfilling social obligations, and protecting one's "face"'* (Hofstede, 1994).

In general, traditional Chinese culture results mainly from the influences of Confucianism (Hofstede and Bond, 1988). From the past to the present, Confucius' thoughts can be regarded as the main core value of Chinese culture. Hofstede (2003) argues that Confucianism is not a religion but a set of pragmatic rules for daily life derived from Chinese history. Confucianism is uniquely compared with the Western dimension, the Eastern dimension is full of questions of spirit and openness (Hofstede and Bond, 1988). On the one hand, Hofstede and Bond (1988) argue that Confucius believes that to create a stable and harmonious society it is critical to understand the relationships between people and the value of each individual in society. In addition, the idea of Confucius has clarified that the family is the rudiment of all social organization (Minkov and Hofstede, 2012). Furthermore, Confucian ethics emphasize harmonious relationships within society, family, and individuals, and have influenced the business practice in Confucian Chinese society (Cheung, 2004).

Figure 1 Hofstede Culture Compass



	Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Long Term Orientation
CHINA	80	20	66	30	87
HONG KONG	68	25	57	29	61
SINGAPORE	74	20	48	8	72
AUSTRIA	11	55	79	70	60
BELGIUM	65	75	54	94	82
NETHERLANDS	38	80	14	53	67

Source: Hofstede et al. (2010)

Hofstede and his research group have summed up a new dimension of his cultural dimensions theory through the study of Confucianism, i.e. *'long-term orientation'* and *'short-term orientation'*. Furthermore, in this dimension is mainly used to measure the degree to which individuals of a single culture group have an incentive to delay the attainment of its emotional and social needs (Hofstede and Bond, 1988). Moreover, the research group suggested intercultural negotiations demand an insight into the range of cultural values to be expected among partners from other countries and compared against the negotiators' own culturally determined values (Hofstede et al., 2010).

On the other hand, Hofstede's country comparison (see Figure 1) states that Confucian Chinese Society is characterized by a larger level of power distance, a high level of collectivism and a larger long-term orientation (Minkov and Hofstede, 2012). This means that people from

high power distance and collectivism cultural backgrounds are unwilling to share decision-making and lack effective communication when working in projects.

Research framework

The prior study of the European set is a part of the Purchasing Education and Research for European Competence Transfer project (PERFECT). The aim of this project is to contribute to the issue of how to design modules for an academic European PSM curriculum that meet the needs of employers for PSM personnel. The European data has investigated online PSM job advertisements in three countries from the European Union. It includes Austria, Belgium and the Netherlands. Previous European studies found common grounds and culturally and structurally induced differences. There is evidence that the common grounds can be seen as a European set of PSM requirements. The job advertisements where found at online platforms in different languages. The frequency of the requirements mentioned in the set of 100 Austrian, 100 Belgian and 100 Dutch were taken in account (Stek et al., 2017).

Based on the research methodology of the European analysis of job requirements in online PSM job advertisements from three distinct European cultural clusters represented by Austria, Belgium and the Netherlands, the study of "Confucian Chinese Society" has performed the same research methods to collect secondary data: online job advisements. Consequently, China, Hong Kong and Singapore are taken in account in this research (see Figure 2). Because in Singapore 74.3 percent of the population constitutes of citizens with a Chinese origin (Lansford, 2014). The frequency of the job requirements mentioned in the set of 100 China, 100 Hong Kong and 100 Singapore were taken in account.

A total of 300 samples will be grouped and coded as different job skills into a fixed competences matrix: KODE®X. KODE®X is an organization-specific competency model that measures personal competencies and structures of individuals and teams in organizational units. The model was developed by two German scholars, and provides externalized statements for personal management and decision makers for continuous personnel development. Following prior study, the "Confucian Chinese society" skill sets are measured using the following constructs: personality competence, activity and action competences, social-communicative competences and methods and professional competences. This is graphically represented in figure 2 below.

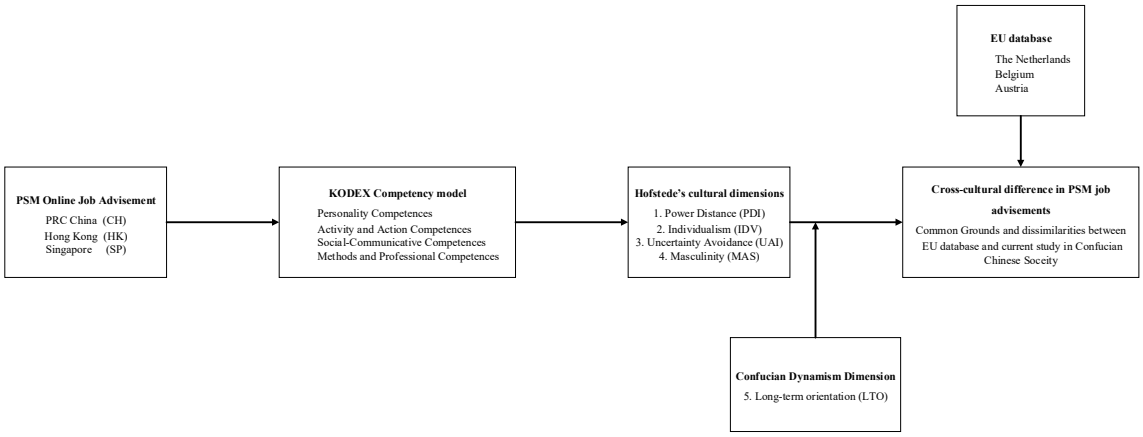


Figure 2. research framework

With the integration of Hofstede's cultural dimensions, Hofstede (1994) describes culture as *'the collective programming of the mind which distinguishes the members of one group or category of people from another'*. Hofstede's theory provides a basic knowledge framework, through the study of his theoretical knowledge, one will understand and analyse the

differences between different cultures. By comparing the collected data from the Confusion Chinese Society and the European dataset, it is possible to investigate whether there are similarities and dissimilarities in the two different cultural groups.

Analysis

In the first phase of this study, Confucian Chinese Society will be introduced. For the initial mass analysis, the study involved three countries from the Confucian Chinese group, chosen to collect and analyse data from. The three countries are China (CH), Hong Kong (HK), Singapore (SP). An initial sample pool of over 300 online job advertisements from the three different countries' job search sites will be collected, resulting in a minimum of 100 job advertisements per country, respectively. The key search terms "Purchaser", "Junior Buyer", "Buyer", "Senior Buyer", "Purchasing Manager" and "Purchasing/ Procurement Engineer" will be employed while sampling on Linkedln, a website for job search and recruitment.

The collected 300 online job advertisements will be processed and classified into different groups with the assistance of KODE®X skill matrix. For example, the keyword shown in the online job advertisements "ability to collaborate with individuals across multiple cultures and geographies" will be translated into "being a team player" and "international mind-set and intercultural sensitivity".

There are over 3,600 variables, which have been coded at this phase. With this result, it is important to better understand what the impact of the 3,600 variables will be, looking at the Confucian Chinese dataset. In addition, with the constructed Confucian Chinese dataset, it is important to further understand and investigate the difference and similarities of PSM professionals' competencies among the three Confucian Chinese Societies. As well as the difference and similarities of PSM professionals' competencies between Confucian Chinese and the dataset from the Europe study.

The data was analysed first in the different Microsoft Excel to calculate frequencies. The outcomes, the similarities and differences were analysed on the underlying details to obtain a more comprehensive picture resulting in about sixty different skills and competencies. Next, a Cell-wise Residual Contingency Table Analysis will be performed in IBM SPSS Statistics 22 by squaring the individual Adjusted Residual per cell of the Cross Tabulation. Subsequently, SPSS calculated the associated P-values per country for each competency in order to find the significant differences and similarities between the three European percentages per skill and the three Confucian Chinese percentages per skill. The null-hypothesis H_0 is: the distribution of averages per skill is equal in each set of three countries. The alternative hypothesis H_A is obviously the opposite. Alpha is set on 0.05 and divided by two: the number of observations (countries) per skill (Beasley and Schumacker, 1995; García-Pérez and Núñez-Antón, 2003). Subsequently a t-test was performed to define the (dis)similarities in the European and Confucian Chinese Society common grounds.

Results

The results of this study offer interesting insights on the job skills between the European and the Confucian Chinese Society. For example, the "*Communicative skills*" has been highly valued by the companies from Confucian Chinese Society. On average 67 percent of job advertisements required that prospective employees are able to transmit and receive messages clearly. However, the demand of people who master effective communication skills in the European job advisements is 20 percent point lower, with an average of 47 percent. The high demand of communication skills in the Confucian Chinese Society also reflects that a company wants the PSM employees to have an understanding on certain languages. Although not reported in table 2, PSM job advertisements in Hong Kong require that potential PSM practitioners are excellent in speaking Cantonese, which is a regional dialect in China.

Hofstede and Bond (1988) argue that European countries have been recognized to be more individualistic and East Asian countries are more collectivistic (see Figure 1). However, our observation indicates that "*Being a team player*" is an important personal competence, which is mentioned in both the European and the Chinese job advisements, with 47 percent and 40 percent displayed in table 1 respectively. Consequently, 12 percent of the companies from Confucian Chinese Society expect their potential PSM employees to have the ability to work in a dynamic working environment across various functions and cultures. Compared to the other five countries, China is compared to Hong Kong and Singapore the latest country on the progress on urbanization, and the PSM professionals need to deal with the uncertainty in the local market resulting from the conflicts between the state government and big corporations (Chaolin et al., 2012). An understanding of Chinese culture and the ability to work with it in the business practise is meaningful.

Following to the data shown above in Figure 1, all three countries of the Confucian Asia Society have a high score on the Confucian Dynamism Dimension (Long Term Orientation). The score indicates that people from the Confucian Chinese Society deal with things more practically and are more goal- oriented. According to the Table 2, "*Process management & Knowledge of Process*" is one of the job requirements that is asked for in the Confucian Chinese Society PSM job markets. On average, 17 percent of the job advertisements require the prospective employee to understand the specific responsibilities and to focus on the goals and reach them.

Table 1
Common grounds – general requirements for European and Confucian Chinese Society purchasers

Common grounds in European and Chinese societies				
		European (n = 300)	Chinese Society (n=300)	z-value
1	Negotiation Ability	140	120	1.6477
2	Being a Team Player	106	98	0.6894
3	Expert Knowledge	66	49	1.7632
4	Having BASc/BSc/MSc Technical study	64	83	-1.8035
5	Proactive/Taking Initiative	59	73	-1.3797
6	Flexibility/Willingness to Travel	57	48	0.9669
7	Ability to Handle Stress/Stress Avoidance	55	70	-1.5078
8	Accuracy/Precision	54	47	0.7637
9	Result-orientated/Pragmatic/Hands-on	53	57	-0.4220
10	Talent for Organising/Organisational Skills	48	46	0.2246
11	Sole-Responsible/Independency	47	57	-1.0784
12	Sense of Responsibility	45	31	1.7184
13	Trustworthiness/Honesty/Reliability	39	26	1.7075
14	Computer Literacy towards ERP systems	36	24	1.6329
15	Proceed in a systematic-methodical manner	26	37	-1.4649
16	Strategic Thinking	25	37	-1.6094
17	Will to learn/Learning Ability/Curious Mindset	19	19	0.0000
18	Innovation Propensity/Innovative	14	12	0.4010
19	Stakeholder Management	10	17	-1.3785
20	Change Management Knowledge	9	8	0.2460

Given the growth in the Asian economies, it is natural to explore the driving forces behind its momentum, including that of effective leadership (McDonald, 2012). McDonald (2012) found that Confucianism offers explanation and insight into the nature of modern Chinese business leadership. With the integration of Hofstede's cultural dimensions, the characteristic of Chinese leadership is closely associated with long-term orientation and collectivism. These two characteristics can be explained as the Chinese spend more time on decision-making rather than action taking. Furthermore, the Chinese decision making is based

on ensuring that all parties can be included and the result of the decision balances advantages against disadvantages. This finding also reflects on this study, leadership skills have been taken into account in the Chinese job market (see Table 2). Employees with a better understanding of the cultural values and features of Chinese leadership in Confusion Chinese society are more effective and successful in building relationships with their co-workers and customers.

Table 2
Common grounds – general requirements for European and Confucian Chinese Society purchasers

Cultural and structural dissimilarities in European and Chinese societies				
	China > Europe	European (n = 300)	Chinese Society (n=300)	z-value
1	Communicative Skills	142	202	-4,952536
2	Procurement or PSM Knowledge	45	187	-11,90409
3	Having Industry Knowledge/Experience	87	154	-5,579492
4	Computer Literacy MS Office (Excel)	85	129	-3,74997
5	Analytical Talent	93	126	-2,798369
6	Interpersonal Skills	47	96	-4,695108
7	Personnel management/Leadership Skills	41	81	-4,057343
8	Project Management Experience & Know-how	31	75	-4,709902
9	Having a BASc/BSc/MSc in Business study	36	68	-3,451184
10	Building Relations/Networking Skills	34	67	-3,600631
11	Ability to Solve Problems	42	66	-2,550307
12	Process Management & Knowledge of Processes	19	52	-4,170927
13	Calculation Knowledge/Numeral Skills	19	45	-3,43856
14	International Mindset and Intercultural Sensibility	8	36	-4,385003
15	Motivative/Inspiring Others	9	34	-3,956888
16	BASc, BSc or MSc degree in PSM	11	33	-3,44536
17	Presentation Skills & Talent for Presentations	5	30	-4,354691
18	Openness towards Change/Change driven	8	19	-2,166253
	Europe > China			
1	Foreign Language Proficiency	241	167	6,476295
2	PSM Job Experience	228	187	3,624512
3	Having at least a BASc degree	194	63	10,8077
4	Result-orientated action-taking/Result Driven	133	13	11,41701
5	Knowledge/Computer Literacy (total)	132	34	8,943403
6	Energy Drive/Endurance	117	19	9,555937
7	Flexibility/Flexible Thinking	104	19	8,595731
8	Business Knowledge & Experience	82	38	4,490731
9	Devotedness	68	23	5,121634
10	Technical Knowledge	63	37	2,848157
11	Customer-oriented	63	28	3,983493
12	Legal Knowledge	57	31	3,000355
13	Advising/Persuasive/Consultancy Skills	51	23	3,476361
14	BASc/BSc/MSc Business *or* Technical	46	23	2,943281
15	Having at least a MSc degree	45	2	6,5333
16	Multidisciplinary/Knowledge of Multiple disciplines	37	16	3,021088
17	Capacity to make decisions/Decisiveness	35	15	2,954196
18	Creative Talent/Creativity	32	7	4,140015
19	Poise/Assertiveness	31	8	3,808814
20	Diplomacy/Social Manners/Political Sense	27	7	3,53149
21	Holistic Thinking/Having Overview	27	0	5,317166
22	Open Communication/Openness/Accessible	19	0	4,429598
23	Ability to handle Complex Situations	17	3	3,184012

Conclusions

This research aimed to examine Hofstede's Cultural Dimension theory and attempt to identify if purchasing skills and competences are culturally determined. With the integration of Hofstede's Cultural Dimension theory, Europe has been recognized more individualistic, for

example, the Netherlands has a higher level of individualism compared to the other five countries in this study. However, while making a comparison between the *"Being a Team Player"* PSM job postings sample in Europe and in Confucian Chinese Society, this personal competence has been equally mentioned from each set of three countries. Consequently, the results suggest that there is no significant difference between Europe and Confucian Chinese Society on the purchasing skills requirements of the job postings in Table 1 above. On the other hand, the Z-values of most variables in Table 2 are greater than the critical value of 1.96, which we set as alpha is significant equals 0.025 (i.e. alpha 0.05 divided by two groups/countries). Therefore, we failed to reject the null hypothesis. The average of competencies and skills from each set of two groups/countries are significantly unequal.

This study also aimed to look for ways in which practitioners and companies can better understand the changing role of PSM job skills in the industry. The outcomes of this research will help practitioners to gain understanding and thus work more efficiently and effectively with their co-workers and customers. In practice, companies could apply the results from the study to provide a practical skills training programme for its employees.

Limitations and future research

In general, our findings lead to new insights into PSM job postings on the two different cultural clusters. Through the study between the European database and the Chinese database, we explained more than 60 personal competences that are demanded by the employers in the current PSM job market. Between the range of two databases, we identified a certain amount of dissimilarities and common grounds between the two cultural clusters.

In addition, this study contributes a large-scale dataset, which could benefit other researchers who are conducting further study on this topic. The findings have given a detailed understanding of job requirements and applicants' capabilities and in particular it gave insight in the cross-cultural differences between PSM job advertisements in Europe and Confucian Chinese Society.

The results presented, also offer a potential lead for future research on a homogeneous research. Hereby, some ideas will be briefly discuss. One of the future research possibilities could be extending the current database, and regroup, the European and Confucian Chinese Society. The new study will only assess companies from outside of Europe, which are employing PSM professionals in the EU job market. On another hand, a database can be collected of foreign companies who are recruiting PSM professionals to work in Confucian Chinese Society. As many businesses have globalized their supply chains nowadays (Carter et al., 2010), the objective of the new study will be the foreign companies who need to make the decision to hire more domestic PSM professionals, very knowledgeable on the local business culture contexts, or to hire international professionals for unique skills unlikely to be found domestically. Furthermore, the future research could be to include semi-structured interviews with a group of human resource managers from companies at both cultural groups. Through interviews with employers a deeper understanding on how intercultural sensibility has its cultural impact on the global division of labour skills at the PSM setting will be reached.

Shortly, there are some limitations to our study which deserve to be mentioned as the KODE®X competences matrix has been a part of our study. The language restriction of the KODE®X model creates some uncertainties for grouping different skill sets to further understand the association between each subject. Therefore, the development of a PSM skills and competences model in a common language for professional or academic purpose is necessary. However, this attempt will be a time-consuming project and needs to be incorporated with different functions and more academic research on relevance needs to be conducted.

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Individual Innovation Sourcing Success
Combining Crucial Skills with Top Management Support

Klaas Stek*[12] klaas.stek@utwente.nl / klaas.stek@tugraz.at
Bernd Markus Zunk[2] bernd.zunk@tugraz.at
Frederik Vos[1] f.g.s.vos@utwente.nl
Holger Schiele[1] h.schiele@utwente.nl

[1] University of Twente, School of Behavioural, Management and Social Sciences, Department of Technology Management & Supply, Drienerlolaan 5, 7522 NB Enschede - The Netherlands

[2] Graz University of Technology, Institute of Business Economics and Industrial Sociology Working Group „Industrial Marketing, Purchasing and Supply Management“, Kopernikusgasse 24/II, 8010 Graz – Austria

*corresponding author, contact by e-mail or +31534894440

Summary: A decade ago Tassabehji and Moorhouse (2008) provided a two-by-two matrix, based on literature reviews and interviews, concluding that a higher level of skills in combination with internal support for strategic purchasing and supply management (PSM) leads to strategic elevation of PSM. Many scholars in the field of ‘purchasing skills’ have cited this article, however no empirical evidence for this assumption was found since 2008. On basis of quantitative data: a purchasing skills survey, this research found evidence that strategic elevation is reached via distinct, significant individual skills if and only if there is top management support for strategic PSM.

Keywords: purchasing skills, innovation success, polynomial

Submission Category: Working paper

Introducing the taxonomy of Tassabehji and Moorhouse (2008) and the need for empirical evidence after one decade

Innovation sourcing and implementation can be described as acquiring access to the innovative solutions of the supplier and implementing these innovations in the own products, services or processes. Since innovation is increasingly outsourced suppliers play an increasing role (Schiele, 2012). Subsequently, the innovation potential of firms is depended on suppliers, because these suppliers possess crucial technological knowledge and skills in R&D and innovation. Therefore, innovation sourcing and implementation is the firm’s most strategic and significant role assigned to the purchasing and supply management (PSM) function within firm’s (Knight et al., 2014; Luzzini and Ronchi, 2011).

Individual, strategic PSM professionals hence need skills to manage the relationship with the main supplier in order to be successful in innovation sourcing and implementation (Feisel et al., 2011; Giunipero and Pearcy, 2000; Knight et al., 2014). Tassabehji and Moorhouse (2008) state that an increased level of individual skills of strategic PSM professionals is not enough and always need to be accompanied with the top management’s support for strategic PSM: *‘(…) Before procurement can be elevated to strategic, the professional first needs to possess a strong set of these underlying skills and competencies (…).*

While skills related to processes and technology (i.e. technical and internal enterprise) are important, by themselves they are not enough to improve a company's procurement performance (…). The (…) skills (…) (are) largely cumulative where one builds on the core procurement skills, to reach the ultimate level of skills to be able to operate strategically. In order to optimise the role of procurement to achieve added value and competitive advantage for the organisation (…), the procurement professional must develop technical (including advanced procurement process skills), interpersonal, internal and external enterprise and strategic business skills coupled with a high degree of support and internal recognition' (see: figure 1) (Tassabehji and Moorhouse, 2008).

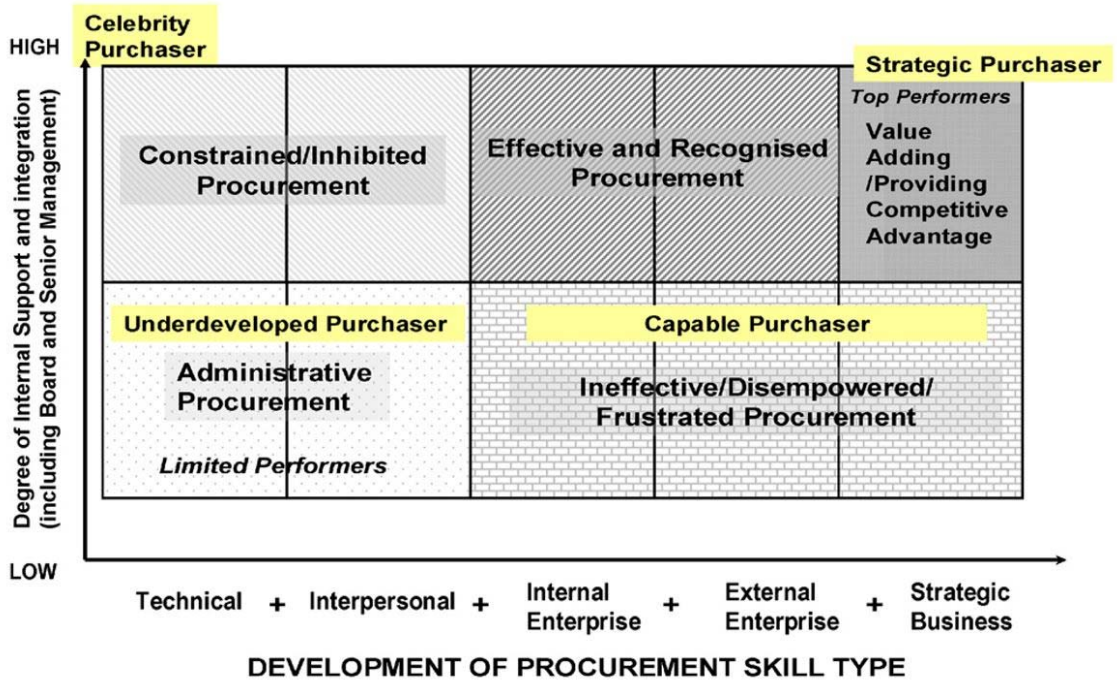

Figure 1 Procurement Effectiveness Matrix of Tassabehji and Moorhouse (2008)

The taxonomy of Tassabehji and Moorhouse (2008) appears 46 times in scopus.com (February 2018) and is therefore relatively well-cited within the field of 'purchasing skills' research. The article seems to have a function as a standard amongst other well-cited articles like Giunipero and Pearcy (2000), Carr and Smeltzer (2000), Cousins et al. (2006), Feisel et al. (2011), Kern et al. (2011) and Knight et al. (2014). When examining the most recent citations it is striking that since 2008 apparently, no empirical evidence is found for the assumptions. The most recent citation, for instance is made by Dubey et al. (2018) who state about the article of Tassabehji and Moorhouse (2008): *'The study has identified the role of organizational support and recognition on procurement skill and its impact on organizational performance'*. Tchokogué et al. (2017) conclude from Tassabehji and Moorhouse (2008) that *'the increasing professionalism of supply managers', 'have influenced greatly how supply management and its strategic contribution have evolved'*. Sinha et al. (2016) associate Tassabehji and Moorhouse (2008) with *'specialized studies of the procurement/purchasing function (that) suggest that the most important skills are "strategic thinking skills" and the purchasing manager's ability to assume "more strategic roles"'.* This small selection of recent articles is illustrative. The assumptions of Tassabehji and Moorhouse (2008) are still of importance, although empirical evidence seems to be lacking.

The Procurement Effectiveness Matrix (see: figure 1) of Tassabehji and Moorhouse (2008) consists of two axes without a clear scale, which can be interpreted as an illustrative 'two-by-two' to explain the concept that the sum of a high level of different skills and a high degree of internal governance support leads to strategic elevation. However, with the assumption that higher levels on both axis together are leading to strategic elevation, Tassabehji and Moorhouse (2008) are adding an extra dimension. In the matrix this strategic elevation is translated in success-terms: purchasing professionals with a low level of skills and a low level of support are 'underdeveloped purchasers' and those with high levels of skills and high levels of support of the top management are 'strategic purchasers' and 'top performers' that are 'effective', 'value adding' and 'providing competitive advantage'.

This study is taking the taxonomy, the matrix, and the assumptions regarding strategic elevation as a starting point and is aiming to test those empirically. The focus of this research is on PSM professionals' most strategic and significant role: innovation sourcing and implementation (Knight et al., 2014; Luzzini and Ronchi, 2011). This study aims to reveal the effect of an increased skills level combined with the level of top management's support for strategic PSM and its' internal recognition. The research questions therefore are:
RQ1: Is there empirical evidence for the taxonomy of Tassabehji and Moorhouse (2008)?
RQ2: Does 1) an increased level of significant skills of innovation focussed PSM professionals in combination with 2) an increased level of support and internal recognition of top management for innovation sourcing and implementation lead to 3) an increased level of individual innovation sourcing and implementation success of those PSM professionals?

The implications of this study are practically and theoretically of importance. Theoretically it aims to find evidence for the underlying assumption of the matrix and taxonomy of Tassabehji and Moorhouse (2008), which has on its turn manifold managerial implications, since the assumption is that both, individual skills level and top management support lead to success in the firm's most important value adding and strategic issues. It therefore contributes to management and theory in both fields: (strategic) skills development and managing a mature innovative atmosphere.

Methodology – towards a new purchasing skills taxonomy

Introduction of the methods section

To come to the answering of the research questions four steps have to be taken on which hereunder is further elaborated in this methodology section: first the PSM professionals with an innovative focus (n=102) were isolated from the results of purchasing skills survey (n=581). The second step is subject of RQ1: in order to find empirical evidence for the taxonomy of Tassabehji and Moorhouse (2008) each of the 88 survey skills was categorised into the taxonomy and subsequently confirmatory and exploratory factor analysis on that set was performed. Third, with a t-test the means on the 88 survey skills items of the purchasing professionals with an innovative focus (n=102) are compared with those of the other survey participants (n=479). The fourth stage is regarding RQ2 and aims to find the relationship between the three variables via polynomial regression with response surface analysis.

European Survey on Purchasing Skills – data collection

This study is part of the project Purchasing Education Research for European Competence Transfer (PERFECT). The main aim of this project is to align academic learning objectives with the needs of practitioners in the field of purchasing and supply management. A part of the research project is to perform an online purchasing skills survey. In summer 2017 via LinkedIn.com, about 3,200 purchasing and supply management professionals were invited personally to fill out the survey. Regarding the question, which particular PSM professional to invite, the LinkedIn-algorithm was leading. In total 581 professionals filled out the survey. The

response rate is thus over 18 percent. The sample (n=581) is Western-European, predominantly Dutch: about two third of the respondents have the Netherlands nationality, twelve percent is French and eight percent is Germanic. A quarter is working in 'service', 35-40 percent in 'industry' and 35-40 percent in the 'public sector'. The spread over the ages is normal distributed.

The survey consists of four different kinds of items. First, the participants' professional purchasing focus was determined. Participants were asked to rank their possible focus on 'costs', 'quality', 'delivery', 'innovation', and 'competitive advantage'. Second, the importance of 88 different skills were self-rated on a 5-point Likert-scale (fully disagree to fully agree). Next, statements on the perceived internal support for innovation sourcing and innovation implementation were self-rated on the same 5-point Likert-scale. Hereafter, statements on individual innovation sourcing and innovation implementation successes were self-rated on the same Likert-scale. In the next paragraph this methodologies are further elaborated on.

Participants ranked 'costs', 'quality', 'delivery', 'innovation' and 'competitive advantage' from rank 1 (most important) to rank 5 (least important). The participants who placed 'innovation' on rank 1 (n=36) and the participants who placed 'innovation' on rank 2 (n=76) are selected for this study. Outliers and incomplete surveys were discarded, which resulted eventually in a final sample of 102 observations.

Statistical methods

The second step of this study is a confirmatory factor analysis with SmartPLS (Ringle et al., 2015) to test the taxonomy of Tassabehji and Moorhouse (2008) with the 88 skills. With the substantial sample size (n=581) this analysis resulted in significant factor loadings of above 0.3 (Hair et al., 2010), Cronbach's Alpha's higher than 0.830, and strong Composite Reliability values. However, the Average Variances Extracted (AVE) are all under 0.5, which was reason to perform the factor analysis again by means of exploratory factor analysis (Varimax with Kaiser Normalisation; Eigenvalue = 1; IBM SPSS22). This analysis resulted eventually in eleven different factors, which are mostly in line with the taxonomy of Tassabehji and Moorhouse (2008): the Technical Skills (TS) are grouped together in three different factors that can respectively be titled as 'purchasing skills', 'analytical skills' and 'eProcurement skills'. The interpersonal skills are found in two factors that can be titled as: 'intrapersonal skills' and 'interpersonal & cultural awareness skills'. The internal enterprise and external enterprise skills load in six distinct factors, however they seem to overlap. Strategic business skills are found within one factor. After this exploratory factor analysis an iterative process of five confirmative factor analyses was performed in order to increase the AVE. Overall, this study seems to supports the taxonomy of Tassabehji and Moorhouse (2008) and is contributing to literature by refining it by stating subcategories and naming the associated skills. In table 3 the new taxonomy on basis of the factor analyses is shown.

RQ2 is regarding the increased level of *significant skills of innovation focussed PSM professionals.* The third step in this study is to find the significant skills of PSM professionals with an innovation focus compared with those who have a non-innovation focus. The participants who ranked 'innovation' as the number-1 or number-2 professional focus were distinguished. Next, a t-test is performed to find the significant skills, which are displayed in appendix 1. The column 'code' is referring to the taxonomy of Tassabehji and Moorhouse (2008): technical skills (TS), interpersonal skills (IS), internal and external enterprise skills (IE/EE) and strategic business skills (SB).

The fourth step in this research comes to the relation between the two predictors (increased skills and support levels) and the outcome variable (increased success rate for PSM professionals in innovation sourcing and implementation). To provide *'a nuanced view of relationships between combinations of two predictor variables and an outcome variable by*

graphing the results of polynomial regression analyses in a three-dimensional space' are applied (Shanock et al., 2010).

The three dimensions in the polynomial regression consists of three constructs. At the x-axis the *Significant Purchasing Innovation Skills' (SPINNS)* are projected. This construct is formed by the means of the 23 significant skills in appendix 1. The y-axis projects *'Internal Innovation Support and Integration' (INTSUP)*. This construct consists of the average means of the nine items regarding the role of the purchasing function in innovation purchasing and development (see: appendix 3). At the z-axis the construct *'Individual Innovation Purchasing Success' (INDINS)* is projected and consists of the average means of the three items on individual success of innovation sourcing professionals (see: appendix 2).

To perform polynomial regression with response surface analysis, a number of conditions have to be satisfied. First, there has to be 'agreement' between the variables, i.e. that the standard deviations have to be within half a standard deviation from each other. Half a standard deviation of the variable on the x-axis is 0.38044 (0.76088 / 2). All standard deviations of the different variables that separately will be projected at the y-axis are in the range 0.38044 to 1.14132, i.e. within half a standard deviation. Vice versa this is also the case (see table 1)

Table 1: standard deviations of the variables on the x- and y-axis

	N	Mean	Std. Deviation
Individual Innovation Success - INDINS	102	3.8264	.65244
Degree of Internal Support and Integration - INTSUP	102	3.3032	.76088
Significant Purchasing Innovation Skills - SPINNS	102	3.5272	.54258

The second condition is met: the variables are all measured on the same numeric scale. For both variables on the x- and y-axis a 5-point Likert-scale is used. Third, the variables share a conceptual domain and fourth the residuals are normally distributed. Figure 2 shows the linearity of the residuals of the dependent variable. Figure 3 shows the normal distribution of the residuals of the dependent variable (INDINS), however Shapiro-Wilk test appears to be significant.

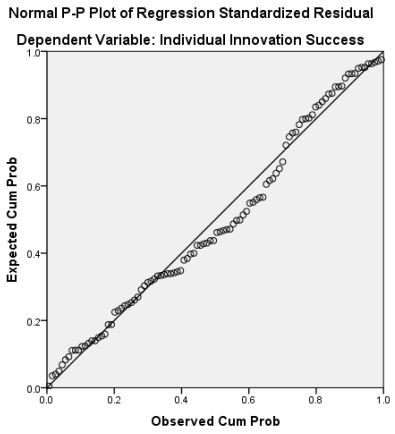

Figure 2: linearity of the residuals

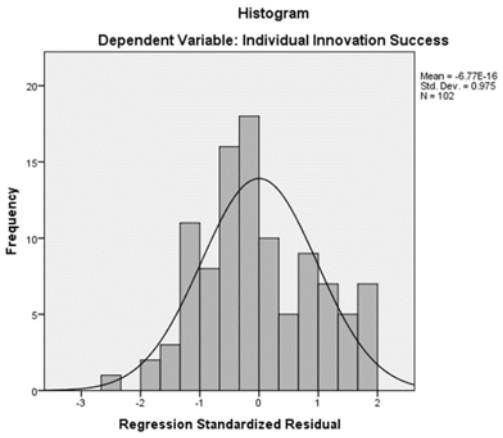

Figure 3: distribution of the residuals

Finally, the variance of inflation (VIF) of both independent variables is 1.00. which means there is no multi-collinearity detected between the independent variables INTSUP and

SPINNS. Herewith the conditions to start polynomial regression are met. *'Before conducting the polynomial regression analyses, it is important to inspect how many participants would be considered to have discrepancies between the two predictors. (…) If it turns out that very few participants have discrepant values (…) the practical value of exploring how discrepancies affect an outcome variable would be small'* (Shanock et al., 2010). Therefore, in SPSS the z-scores of the new computed y-axis variable (INTSUP) and x-axis variable are calculated (SPINNS). Both z-scores are subtracted from each other. These new groups were examined on the spread of the z-scores. Table 2 shows that the discrepant data (that is more than half a standard deviation above or below standardized score of zero; i.e. the section of < -0.5 and the section of > 0.5) is higher than 10 percent (resp. 29 and 34 present), which is a condition to perform further polynomial regressions. Polynomial regression was performed according Shanock et al. (2010).

Table 2: Level of agreement in z-value levels of the independent variables

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< -0.5	29	28.4	**29.0**	29.0
	-0.49 to 0.49	37	36.3	37.0	66.0
	> 0.5	34	33.3	**34.0**	100.0
	Total	100	98.0	100.0	
Missing	System	2	2.0		
Total		102	100.0		

Results – a new purchasing skills taxonomy and empirical evidence for the decade-old assumptions

Regarding RQ1: on basis of the taxonomy of Tassabehji and Moorhouse (2008) table 3 is displaying the different factors and the associated skills and knowledge area's that could be derived from the iterative factor analyses. Five iterations took place. The first attempt was unsuccessful by grouping low-score loading in the factors 'basic purchasing skills' and 'internal planning & cooperation': Request for Quotation; Cooperation with Legal Department; Evaluating Offers; Forecasting of the Demand; ERP; Make-or-Buy; and Customer orientation. In the second iteration, these skills were all shared under 'basic purchasing skills', which gave a better, however not satisfying result. The third iteration consisted of the distinction between intrapersonal skills and interpersonal skill. In the fourth and fifth iteration the skills mentioned in first iteration were placed on eventually the factor that table 3 is showing. All factors have significant loadings higher than .55 (n=102) (Hair et al., 2010), except Commodity Knowledge (.50); Cooperation with Legal Department (.50); Contract Development (.53); Customer orientation (.40); Developing Specifications for Supplies (.43); Forecasting of the Demand (.44); Request for Quotation (.54); and Stakeholder Relationship Management (.53).

Regarding RQ2: the polynomial regression leads to a three-dimensional image as displayed in figure 5. Table 4 shows that (only) the slope on the diagonal x equals y is significant. The slope is ascending from (-2, -2, -0.13) to (2, 2, 4.02) (table 5). This means that the assumption of Tassabehji and Moorhouse (2008) is supported: a higher level of significant purchasing innovation skills, if and only if combined with a higher degree of internal support and integration, leads to an increase of individual innovation success. This means there seems to exist additive effects and no complementary. Neither one of the predicting variables can be replaced by the other, e.g. and increased level of *Significant Purchasing Innovation Skills* (SPINNS) only leads to a higher level of individual innovation purchasing success (INDINS) when there is an increased level of *'Internal Innovation Support and Integration' (INTSUP).*

Table 3: new purchasing skills taxonomy based on Tassabehji and Moorhouse (2008) and on empirical evidence

TS	basic purchasing	Claims management; Commodity Knowledge; Contract Development; Contract Management; Cost Analysis; Developing Specifications for Supplies; Global Sourcing; ERP; Make-or-Buy Decisions; Negotiation.
	analytical	Big Data analysis; Cost Reduction Techniques (Act of cutting costs to improve profitability; e.g. by analysis and statistics); Set key performance indicators (KPI's); Performance Measurement and Follow-up; Portfolio Analysis; Statistical Analysis.
	eProcurement	Procurement IT Systems / eProcurement applications; Automation of Purchasing
IS	intrapersonal traits	Complexity understanding; Conscientiousness; Creativity; Holistic thinking; Honesty; Inventiveness; Learning ability; Loyalty; Problem-solving; Personality Development; Poise; Proactivity; Self-Assurance; Risk-taking, Result-driven;
	interpersonal & cross-cultural	Advice skills; Communication; Conflict-solving; Cross-cultural awareness; Customer-orientation; Empathy; Networking; Persuasion; Salesmanship; Social Manners; Stakeholder Relationship Management; Team-ability.
IE	human resource & leadership	Change management; Cooperation with HRM department; Employer Development; Employer Performance Measurement; Defining Roles & Profiles; Leadership; Personnel Selection; Project Management; Training Personnel.
	internal planning & cooperation	Cooperation with Logistics, Marketing, Production, Quality and R&D; Supply Chain Analysis; Technical Knowledge
	portfolio strategy	Category Strategy Development; Cooperation with Legal department; Forecasting of the Demand; Supply Market Analysis; Pooling of the Demand; Request for Quotations.
EE	supplier management	Early Supplier Involvement; Process of becoming Strategic Business Partner of the supplier; Supplier Development; Supplier Evaluation; Supply Risk Management.
	innovation & technology	Innovation Implementation; Innovation Sourcing (external scan); Technology planning (internal scan)
	social responsibility	Corporate Social Responsibility; Sustainable Purchasing
SB	strategic purchasing	Corporate Governance, Know-how to add value to the organisation with purchasing; Knowing the position of purchasing in the organisation; Optimisation of Purchasing Processes; Process Management; Purchasing Knowledge; Strategic Management.

Table 4: Testing Slopes and Curves of figure 5 and regression table

Testing Slopes and Curves – Total set of skills

Effect	Coefficient	Standard Error	Test Stat (t)	*p*-value	
a_1: Slope along x = y (as related to z)	1,04	.44	2,356	.021	**Sig!**
a_2: Curvature on x = y (as related to z)	-.30	.21	1,433	.155	
a_3: Slope along x = -y (as related to z)	.47	.52	.904	.368	
a_4: Curvature on x = -y (as related to z)	-.11	.34	-.325	.746	

Table 5: regression table belonging to figure 5

Points to Plot

		X				
		-2	**-1**	**0**	**1**	**2**
	2	1,76	3,05	3,86	4,18	4,02
	1	1,18	2,57	3,44	3,89	3,82
Y	**0**	0,68	2,16	3,15	3,67	3,70
	-1	0,24	1,81	2,91	3,52	3,64
	-2	-0,13	1,54	2,73	3,43	3,66

Note: Diagonal is line of congruence (x = y); Below the diagonal X>Y; Above the diagonal X<Y

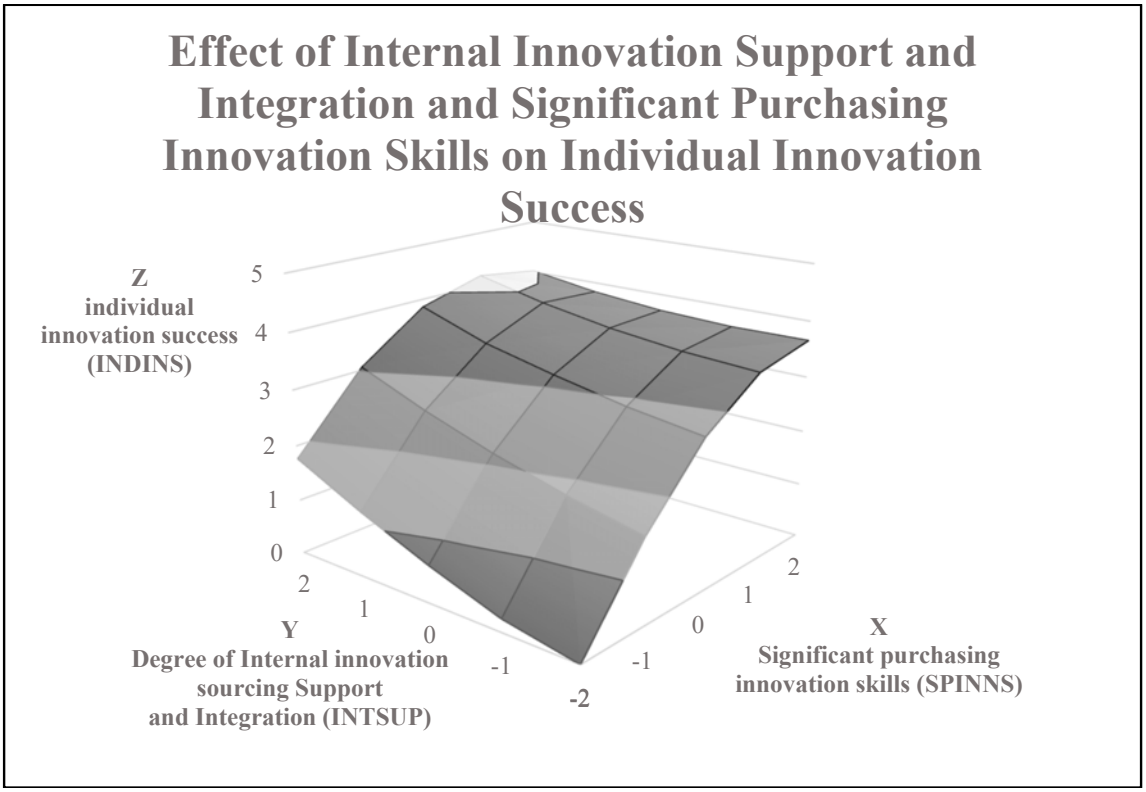

Figure 5: Effect of Internal Innovation Sourcing Support & Integration and Significant Purchasing Innovation Skills on the level of Individual Innovation Success

Discussion – Innovation-sourcing success has two sides of a coin: purchasing innovation skills development and internal purchasing innovation support

As mentioned, there is evidence that the assumptions of Tassabehji and Moorhouse (2008) are supported (RQ2). A higher level of skills significantly belonging to innovation sourcing professionals, if and only if there is a higher level of support from top management for innovation sourcing, is leading to a higher level of success of individual purchasing professionals in the field of innovation sourcing and innovation implementation. Next, this study provides empirical evidence for the taxonomy of Tassabehji and Moorhouse (2008) (RQ1). It is extending the skills list of the taxonomy with its 88 skills and is categorizing them accordingly. Moreover, this study refines the taxonomy and divides the original five groups up into eleven factors, with substantial factor loadings and a high to reasonable AVE.

This study therefore contributes not only to literature but also to management practice: the outcome is most likely to be disappointing for dedicated, well-skilled innovation sourcing agents with no top management support. Tassabehji and Moorhouse (2008) in their paper referred to those strategic professionals as: '*ineffective, disempowered and frustrated*'. There is no reason to assume that these characterisations have to be adjusted on basis of this research.

This study has taken innovation-focussed professionals in consideration: hailing from industry, service and public procurement and contributes to the knowledge on innovation-related skills of purchasing professionals. Appendix 1 is displaying the skills that significantly belong to these professionals. The main take-away for managerial use is that innovation-sourcing success is reached via distinct, significant individual skills (appendix 1) but only when there is also top management support. i.e. a mature innovative atmosphere (appendix 3).

The sample sizes are considerable; however, the limitation of this research is that the sample is predominantly from one country: over two third of the respondents are from the Netherlands. As mentioned, some factor loadings or not significant and it is doubtful if these

items can be maintained under the specific factor. The Shapiro-Wilk test for the spread of the residuals of the dependent variable is significant; there is no normal distribution.

Within this study the sample (n=102) could be enlarged when the participants with a focus on innovation and/or competitive advantage on rank #1 and/or #2 (n=207). This would probably affect the Shapiro-Wilk test in a positive way. Further research could be performed on replicating this study outside the Netherlands to test first the groupings that are presented in table 3. Secondly, a replication could test the finding that a higher level of skills only in combination with top managements' support is leading to a higher level of success of individual purchasing professionals.

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Appendices

Appendix 1: Significant distinct skills items of innovation focussed purchasing professionals

What is the importance of this task for your function?	**code**	**sign.**
Making cost analyses - For example: calculation of the total costs of ownership or other cost calculations.	TS1	.002
Cost Reduction Techniques - Act of cutting costs to improve profitability (e.g. by analysis and statistics)	TS2	.006
Negotiation the Specific Terms - To make a contract the specific commercial and legal terms need to be settled in a satisfactory way for your organisation.	TS3	.021
Solicit Offers (RfQ / RfP / RfI) Request for Quotation (RfQ) / Proposal (RfP) / Information (RfI) - Inviting suppliers to submit a bid, which meets the requirements as laid down in the request.	TS4	.038
Evaluate Offers & Supplier Selection - Knowledge on how to ensure that purchasing plays an adequate role in the organisation	TS5	.039
Global Sourcing / Supplier Acquisition - Sourcing materials, processes, designs, technologies and suppliers from global market / acquiring new global suppliers.	TS6	.049
Creativity - Being creative in professional life	IS1	.000
Capacity to Advice - Having consultancy skills	IS2	.001
Inventiveness - Being imaginativeness	IS3	.006
Honesty - Being trustworthy in professional life	IS4	.013
Ability to Resolve Conflicts - Being able to avoid and resolve conflicts	IS5	.014
Willingness to take risks	IS6	.026
Comprehension of Complexity	IS7	.033
Innovation Implementation - Implementing suppliers innovations in the own organization.	IE1	.000
Project Management Skills - The discipline of initiating, planning, executing, controlling, and closing the work of a team to meet specific goals.	IE2	.003
Working together with the department Marketing Management - Knowing basics about Marketing Management (or Public Relations) and knowing how to establish/maintain the relationship.	IE3	.005
Managing change processes - The ability to lead a team or group through a change process.	IE4	.025
Working together with the department Research and Development - Knowing basics about Research & Development and knowing how to establish/maintain the relationship.	IE5	.026
Working together with the department Human Resources Management - Knowing basics about Human Resources Management and knowing how to establish/maintain the relationship	IE6	.042
Innovation Sourcing (External scan). This requires a systematic scan of the solutions available on the supply market.	EE1	.001
Early Supplier Involvement - Inviting the supplier in the new product development process from a very early stage.	EE2	.003
Sustainability - Sustainable purchasing: considering environmental, social, ethical and economic issues in the management of the organization's external resources.	EE3	.009
Corporate Governance - Knowledge on how organisations are governed, including board, role of advisory board, stakeholders etc.	SB1	.000

Appendix 2: Dependent variables on innovation success

Grade to what extent you agree these statements belong to you. Due to my actions …	
DVInnovation_1	…product and process improvements have been implemented.
DVInnovation_2	…we achieved more product and process improvements than average.
DVInnovation_3	…we identified more useful ideas with suppliers than the benchmark.

Appendix 3: 9 items on Innovation Support within organisations

Grade to what extent you agree these statements belong to your organisation.	
IN1_ImportantRoleNPD	Purchasing plays an important role in new product development in cross-functional teams and continuous improvement efforts.
IN2_LeaderRoleNPD	Purchasing takes a leadership role in new product development in cross-functional teams and continuous improvement efforts.
Please indicate the use of the following tools and practices within your organisation.	
IN3_InnovWorkshops	Innovation workshops to which the supplier is required to make a contribution.
IN4_PrefSupplList	Mandatory preferred supplier list.
IN5_CrossFunctInnov	A cross-functional innovation council with purchasing participation decides on budget allocation for innovation projects.
IN6_StratInnovContr	Strategic innovation controlling (e.g. development goals, product portfolios).
IN7_MeasSupplInnov	Measuring suppliers' contribution to innovation.
IN8_PurchInnovObject	Innovation is part of purchasers' objectives.
IN9_SupplRiskSharing	Agreement on risk and/or profit-sharing with important suppliers.

Purchasing skills leading to success
A contingency approach for industry, service and public procurement

Klaas Stek*[12] klaas.stek@utwente.nl / klaas.stek@tugraz.at
Bernd Markus Zunk[2] bernd.zunk@tugraz.at
Holger Schiele[1] h.schiele@utwente.nl

[1] University of Twente, School of Behavioural, Management and Social Sciences, Department of Technology Management & Supply, Drienerlolaan 5, 7522 NB Enschede - The Netherlands

[2] Graz University of Technology, Institute of Business Economics and Industrial Sociology Working Group „Industrial Marketing, Purchasing and Supply Management“, Kopernikusgasse 24/II, 8010 Graz – Austria

*corresponding author, contact by e-mail or +31534894440

Summary: Purchasing agents from industry, service and public procurement (n=581) took part in a survey on 88 purchasing skills and were asked about their focus and success. Success skills depend on the sector. Per sector significant skills of successful purchasing agents (with a strategic focus) appear, however a clear profile could not be made; some success skills in some sectors seem to be in hands of a higher educated, slightly older, male-dominated group. Practitioners, recruiters and educators have the task to bridge the gap by acquiring these skills and adopting them in learning objectives and curricula.

Keywords: Purchasing skills, focus, industry, success.

Submission Category: Working paper

Introduction – gap in the PSM skills literature on success factors

The level of the individual competencies and performances of PSM professionals relates positively to the success of purchasing and supply management (PSM) in firms (Carr and Smeltzer, 2000; Giunipero et al., 1999; Kaufmann and Carter, 2006; Mulder et al., 2005; Schiele, 2007; Shou and Wang, 2015; Tate and Ellram, 2012).

Although there is a vast range of PSM literature on skills and knowledge (hereafter: ‘skills’) which are needed in PSM in general (e.g. Cousins et al., 2006; Faes et al., 2001; Giunipero and Pearcy, 2000; Knight et al., 2014; Tassabehji and Moorhouse, 2008), there is limited knowledge on which skills in particular are needed by PSM professionals (Bahouth et al., 2014); let alone what specific skills lead to success. Moreover, the question is how applicable ‘general needs’ are for professionals in the field of PSM? And do these skills lead to success in ‘industry’, ‘services’ and ‘public procurement’? Knowledge on specific skills of highly effective or successful PSM professionals seems to be missing in scientific literature. In their novel work Knight et al. (2014) did find three clusters (routine, tactical and strategic buying) of skills and projected them on the Kraljic purchasing portfolio matrix (Kraljic, 1983). However, the research of Knight et al. (2014) did not reveal the skills of the most successful or effective PSM professionals.

PSM professionals can have different focuses. Literature distinguishes firstly a PSM focus on lowest cost, i.e. buying supplies to the lowest possible costs or total cost of ownership. The focus on quality means buying supplies with an appropriate quality. A focus on delivery is ensuring safe, timely and sufficient supply with suppliers who have the capacity to deliver the

desired volumes. The PSM function may also focus on ensuring access to the suppliers' innovations: the purchasing of innovative solutions or facilitating innovations from and with suppliers (Foerstl et al., 2013; Hesping and Schiele, 2015; Krause et al., 2009). PSM can have an important role in achieving the firms long-term or sustained competitive advantage strategy, which leads to exclusive access to sources of suppliers; taking the resource-based-view of Barney (1991). The aim of this paper is to reveal the significant skills of successful and effective PSM professionals. For this reason PSM professionals with a transactional role, i.e. having a focus on lowering costs, improving quality and ensuring safe supplies are left out of this research. This research aims on PSM professionals that are involved in achieving sustained competitive advantage (Barney, 1991, 2012) and in acquiring access to the suppliers' innovations and implementation in the own product or process. *'Innovation is by far one of the most important competitive priorities in the current business context. Companies increasingly rely on their supply base to support their innovation potential. As a consequence, the purchasing department might dramatically affect the firm's innovation capability'* (Luzzini and Ronchi, 2011). The research questions of this paper therefore is:

- Which PSM skills are significantly associated with strategic PSM professionals per sector?

Literature on PSM skills and competencies seems to fall short when it comes to describing what PSM skills lead to success. This study fills this gap with the analyses of the outcomes of a large European online PSM skills survey that took place in the summer of 2017 (n=581). The subsample of strategic PSM professionals is 207.

Methodology – deriving of purchasing skills that lead to success

This study is done in the framework of the project Purchasing Education Research for European Competence Transfer (PERFECT). The main objective of this project is the alignment of academic learning objectives with the PSM needs in firm and organisations. An online purchasing skills survey is part of the research project. About 3,200 PSM professionals were personally invited to fill out the PSM skills survey via LinkedIn.com in summer 2017 (n=581 / response: >18%). The sample is Western-European, predominantly Dutch: about two third of the respondents have the Netherlands nationality, eleven percent is French and eight percent is Germanic. A quarter of the population is working in 'service', 38 percent in 'industry' and 37 percent in the 'public sector'. The spread over the ages is normal distributed.

The design of the survey consists of four different kinds of items. First, the professional PSM focus was determined. Participants were asked to rank their possible focus on 'costs', 'quality', 'delivery', 'innovation', and 'competitive advantage'. Second, the importance of 88 different skills were self-rated on a 5-point Likert-scale (fully disagree to fully agree). The descriptions of the survey and the 88 skills are published online (PERFECT, 2017). The participants were further questioned about their individually success rates in costs, quality, delivery, innovation, and long-term competitive advantage.

First, the sector in which the participant is employed ('industry', 'service', or 'public') is combined with the focus (rank #1 and/or rank #2: 'innovation', and 'competitive advantage'). This lead to a sample of 207 subjects in six groups (three sectors and two focuses; see: table 1). Second, a set of constructs of the individual and department's success-items on 'innovation' and 'competitive advantage' were made. Next, the 'successful' participants were determined and were distinguished from the 'unsuccessful' participants in SPSS22 by means of a dummy variable. To be 'successful', for this study the participant has to have an average score equal to 4 or higher on a 5-point-Likert-scale ('agree' and 'fully agree') on the construct. With a one-way analysis of covariance (ANCOVA) per sector and focus, the 88 skills importance levels of

the both ‘successful’ and the ‘unsuccessful’ were compared. The results of the one-tailed tests are subsequently combined in table 2.

Table 1. Focus on 'innovation' and/or 'competitive advantage' ranked at #1 and #2	innovation	competitive advantage	innovation AND competitive advantage	Total
secondary sector - industry / construction / manufacturing / mining	17	33	15	65
tertiary sector - service / trade / transport / finance	22	36	6	64
quaternary sector - public procurement / public health / public education	42	26	10	129
	81	95	31	207

Table 2. Significant skills belonging to PSM professionals with focus on innovation sourcing and/or sustained competitive advantage (Skill | sign)

INDUSTRY		SERVICE		PUBLIC	
Advanced Purchasing skills					
Contract Management	.0232	Contract Management	.0221	Automation of PSM processes	.0415
Soliciting Offers / RfQ	.0354	Specification of Demands	.0106	Specification of Demands	.0404
Global Sourcing	.0134	Commodity Knowledge	.0213		
		Performance Measurement	**.0090**		
		Negotiation	**.0097**		
Intrapersonal skills					
		Self-Assurance	.0126	Self-Assurance	**.0093**
		Poise	**.0003**		
		1nventiveness	**.0036**		
Interpersonal skills					
Cross-Cultural Awareness	.0110	Cross-Cultural Awareness	.0222	Cross-Cultural Awareness	.0372
Social Manners	**.0098**	Empathy	**.0034**	Social Manners	.0263
Salesmanship Skills	.0414	Persuasion	.0176		
Internal enterprise skills					
1nnovation Implementation	.0396	1nnovation Implementation	.0404	Project Management Skills	.0475
Cooperation with HRM	.0338	Cooperation with Logistics	.0100	Cooperation with Logistics	.0157
Employee Performance Meas.	.0445	Cooperation with Legal	.0257	Employee Performance Meas.	.0400
Enterprise Resource Planning	.0430	Technical Planning (internal)	.0113	Technical Planning (internal)	**.0038**
		Change Management	.0153	Defining Job Roles & Profiles	.0255
		Cooperation with Quality	.0149		
		Cooperation with Marketing	.0239		
External enterprise skills					
Innovation Sourcing	.0437	Supply Market Analysis	.0210	Portfolio Analysis	.0301
				Supplier Evaluation	**.0052**
				Supplier Development	**.0053**
				Early Supplier Involvement	.0212
Strategic Business Skills					
		Know how to Add Value to the Organisation with PSM	**.0031**		

Results – success depends on sector and focus

In table 2 the results of the ANCOVA are displayed. These significant skills are categorized according the taxonomy of Tassabehji and Moorhouse (2008). These can be seen as advanced skills that belong to successful PSM professionals with a focus on innovation sourcing and sustained competitive advantage. The successful PSM professionals in industry, service and public procurement have significant skills in common, like: contract management;

developing specifications for supplies; self-assurance; cross-cultural awareness; social manners; innovation implementation; cooperation with colleagues in different departments; technical planning (internal scan); and HRM-related subjects like employee performance measurement.

Some significant differences appear between the sample 'non-successful' and the 'successful'. The successful agents that are focussed at 'sustained competitive advantage' are compared to the unsuccessful (slightly) older (43.5 and 44.6 y/o with .011 significance) and more often male (sign. .001). The successful professionals focused on 'innovation sourcing' are higher educated (sign. .001). The differences ('unsuccessful'/'successful') are for PhD's 1.2 vs. 5.1 percent and MSc's 40.4 vs. 54.4 percent. No significant difference between study disciplines or between nationalities are found. Unfortunately, the successful PSM professional could not be profiled.

Conclusions - significant 'success' skills ratio differs over the sectors

In literature not much is known about PSM skills in association with success factors. Knight et al. (2014) may be an exemption and distinguish three clusters with types of PSM professionals: a 'routine product type', a 'tactical purchasing type' and a 'strategic purchase type'. Knight et al. (2014) state that: *'The strategic purchase profile fits well with the supply management quadrant'* of the matrix of Kraljic (1983). The tactical purchase profile '*fits well with Kraljic (1983) 'leverage item'*' (Knight et al., 2014). The survey items of Knight et al. (2014) are not identical with the items of the survey of this study and also the focus of the research is not in accordance; Knight et al. (2014) is clustering the most important skills in the framework of the portfolio matrix of Kraljic (1983) and this study's approach is to distinct the advanced skills of successful PSM professionals. Nevertheless, the outcomes of this research seem to be in line with the outcomes and especially the categorisation of Knight et al. (2014). Skills in both studies are matching at the strategic profile.

As mentioned, similarities are shown, but also differences between the sectors appear. Successful PSM-professionals in the service-sector seem to be equipped with the largest number of significant skills. Or in other words: the 'unsuccessful' PSM professionals lack these significant 'success'-skills. In industry the differences between the 'unsuccessful' and 'successful' are smaller than in the service sector and public procurement. The conclusion is that the professionally level in the purchasing function in industry is higher than in the other two sectors.

In public procurement the results under the category 'external enterprise skills' are remarkable. Successful public procurement agents have skills and perform apparently activities that at the first glance not seem to fit with the rules and regulations for tenders in public procurement: supplier development and early supplier involvement, which are activities that have to be seen within the context of a rather close relationship with the supplier.

Managerial implications

There seems to be a watershed between professional who have or do not have 'purchasing skills leading to success'. Moreover, it depends on what sector the practitioner is employed. Significant skills are in some cases possessed by a slightly older, higher educated, male-dominated group, however this does not count for all focuses and sectors. On basis of this study it is difficult to define the profile of a successful PSM professional. Nevertheless, there are distinct PSM agents who possess skills that are associated with success. These skills sets are of value for individual PSM professionals, their employers and educators.

Practitioners and recruiters as well as educators in PSM first have to ensure that the 'basic' skills are acquired and covered in academic learning programs to bridge the gap between the 'successful' and 'unsuccessful' in order to increase the level of the individual competencies

and performances of PSM professionals, which relates positively to the success of PSM in firms (Carr and Smeltzer, 2000; Giunipero et al., 1999; Kaufmann and Carter, 2006; Mulder et al., 2005; Schiele, 2007; Shou and Wang, 2015; Tate and Ellram, 2012).

Limitations and further research

Two-third of the subjects have the Dutch nationality. The Netherlands' economy is mostly focused on service and (international) trade, which might affect the outcomes. It is worthwhile to find out why successful public procurement agents are involved in supplier development and early supplier involvement.

Despite the broad range of items, this research was not able to profile the successful professionals. Further research could concentrate on finding distinct profiles.

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Open Innovation to achieve Supply Chain Sustainability: a Systematic Literature Review

Hannah Stolze
Wheaton College, 501 College Ave., Wheaton IL 60178 (USA)
hannah.stolze@wheaton.edu

Anthony S. Roath
School of Management, University of Bath, BA2 7AY Bath, (UK)
A.S.Roath@bath.ac.uk

Marco Formentini
Audencia Business School, 8, Rue de la Joneliere, 44312 Nantes (France)
mformentini@audencia.com

Summary
This paper adopts a systematic review of abstracts to provide an overview of the concepts associated with open innovation, sustainability and the supply chain literatures. This overview is then followed with a systematic analysis of selected research. Ultimately, this systematic review will lead to a conceptual framework to depict the underlying approach to developing a sustainable competitive advantage through innovation within the supply chain network.

Keywords: Open Innovation, Sustainability, Sustainable Supply Chain Management; Systematic Literature Review

Introduction

Exploiting proprietary innovation has been a firm's business model practice which has produced great success for organizations. Yet, markets that have seen decreased and more limited access to resources have challenged firms' practice of internal innovation. In other words, it is no longer enough to create value, a firm must also capture value to ensure a more sustained development and competitive advantage. Capturing value is dependent greatly upon the organization's ability to innovate; a capability which is no longer the domain of a single firm. Instead, innovation ability relies increasingly on gathering and incorporating knowledge and innovation from other firms which may form part of the focal firm's supply chain network (von Hippel, 1988). Indeed, a growing awareness is that the reliance upon internal development is less productive and may even be less attractive as a means to realize sustainable competitive advantage or sustainable development. These circumstances are prompting some organizations to extend their innovation efforts outside of their firm's boundaries to capture opportunities (Chesborough, 2003; Laursen and Salter, 2006). Hence, companies are more reliant upon their supply chain networks to obtain and leverage resources which could also be used to enhance their ability to develop innovative capabilities.

Yet, the way in which firms actually manage innovation within their network to ensure sustainable development is not understood well (Isaksson, Johansson, Fischer, 2010; Pagell and Shevchenko, 2014). Consequently, the primary motivation for this paper is the realization that an internal focus on proprietary innovation poses particular risks in a market of reduced access to resources. As companies confront these risks, collaboration with supply chain partners with

innovation as one of its main goals, becomes increasingly important to compete efficiently (Adner and Kapoor, 2009). Indeed, interfirm collaboration highlights innovation as a basis for sustained efficiency and effectiveness and thus, an increasing practice within the supply chain (e.g., Chesborough, 2003; Chesborough, 2006; Dahlander and Gann, 2010).

Leveraging innovation may not be enough. The process of innovation suggests that the firm is adopting a long-term outlook; companies still seek a strong guarantee of maintaining access to knowledge and scarce resources through innovation approaches and processes. The benefits of extending resources through collaborative efforts among supply chain partners in the form of knowledge exploration and exploitation addresses the question of *why* companies leverage innovation. Moreover, collaboration through knowledge and innovation within the supply chain suggests *what* companies receive by adopting open innovation practices. A quick assessment of these questions indicates that companies gain a degree of knowledge which contributes to not only immediate or short-term performance, but also knowledge that increases the potential for long-term, sustainable development.

The proposition follows that leveraging innovation within the supply chain network can and should contribute to a firm's sustainability. The concept of open innovation as a firm's practice and influence on value creation and capture sustainability within the supply chain requires an assessment of the current conceptual frameworks to help provide some coherence to the different perspectives reflected in the research. To address this shortcoming, a systematic review is timely and relevant. It is also an important means to build upon the literature's foundation to help advance the area's research and in particular, to bring more concentration to theory development. Consequently, middle-range theory over a meta-theory approach is the more appropriate. The middle-range theory addresses theoretical development based upon improving conceptualizations, measures and relationships among concepts identified by the macro thread. Middle range theory advances the macro conceptualization by integrating high-level theory with empirical testing and analysis. The present review highlights several dimensions and provides some direction to focus upon an analytical framework that drives closer to addressing the question of how firms achieve sustainability through open innovation within the supply chain network.

The present paper analyses how research has examined organizations' application of open innovation within the supply chain network and whether the extant research explores open innovation as a supply chain phenomenon that advances supply chain sustainability. Accordingly, the paper makes two key contributions; from an extensive literature review it identifies, and ties together the business model approach of open innovation to supply chain sustainability theoretical development. This first contribution outlines open innovation as the bridging literature between supply chain management and sustainable supply chain management literature bases. Highlighting this addresses the question of *how* open innovation can be used to develop sustainability in the supply chain. The second contribution identifies research opportunities by outlining the 'common' concepts and relationships from the separate literatures utilizing the middle range theory approach.

This paper begins with overviews of open innovation, supply chain management network and sustainable supply chain management literatures to support the open innovation concept which links supply chain network and sustainable supply chain management literatures. Ultimately, the paper argues for the relevance of open innovation to sustainability within the supply chain network. This overview is followed by the methodology, an analysis of the systematic review and a discussion of how the review informs the development of a conceptual framework from a middle-range theoretical approach. The paper also includes suggestions for a research agenda and some recommendations for how to employ open innovation practices to increase the opportunity for sustainable development.

Innovation to open innovation network

Innovation reflects interactive learning and knowledge dissemination to create value. Innovation as is practiced internally is largely a closed process predicated on the idea that the firm gains competitive advantage from innovation and the control of innovation it produces in the market. Currently, innovation research from this perspective examines *intra*firm phenomenon. However, internal innovation may be based on knowledge assets outside the company and introduced into the company through cooperation or collaboration with other firms in the supply chain network (Chesborough, 2003). Exploiting knowledge 'sourced' from beyond the firm's boundaries may be a good means to generate new ideas and take them quickly to market without expending a lot of investment in resources. It is also a way to extend an organization's resources and ultimately, market reach.

Open innovation has emerged as a concept for understanding the nature of innovation among supply chain partners and how organizations manage the innovation process to achieve success. The practice of exploration is the foundation of open innovation; a business model oriented to purposeful and reciprocal flow of innovation outflow extending beyond a firm's contractual boundaries (Chesborough, 2003; Chesborough, 2006; Almirall and Casadesus-Masanell, 2010). The concept is grounded in the realization that some form of collaboration is crucial as knowledge becomes more distributed. The fundamental idea of open innovation is that the firm potentially builds upon internal innovation by incorporating enhancements to innovations that other companies produce. In this context, an organization enhances its innovation efforts by utilizing assets In short, innovation can reflect a firm's approach to create and capture value, but increasingly, it is becoming more challenging to create and capture value independently given the circumstances of diminishing resource access. Consequently, innovation has evolved into a more interdependent endeavor that acknowledges the need and the benefits from firm partnerships. Understanding this interaction to create and capture value is the impetus behind open innovation.

There is a well-defined and growing body of literature within the management literature that investigates open innovation from the perspective of a business model (e.g. Chesborough, 2003; Chesborough, 2006; West and Bogers 2014). Yet, the open innovation research has primarily been conducted from a meta-theory view with little covering how open innovation within the supply chain network influences a firm's ability to sustain a competitive advantage. Interestingly however, some open innovation literature has presented sustainability as an outcome of open innovation (business model) practices that provide a path to competitive advantage (Hall and Wagner, 2012). In fact, Unilever's Sustainable Living Plan outlines key areas for innovation with outside partners that would help reduce environmental impact while inducing continual business growth. The company states that:

"We have a vision of a better future for our world and our business – and we want partners to share it. If you have a new design or technology that could help us grow our business and solve the challenges we've set ourselves, we'd like to work with you though Open Innovation." (www.unilever.co.uk/about/innovation/open-innovation)

Open innovation and sustainability

An organization's objective of long-term competitiveness invokes the concept of sustainability (Carter and Rogers, 2008). Pagell and Shevchenko (2014) build upon earlier conceptualizations of sustainable supply chain management by defining it as "designing, organizing, coordinating, and controlling of supply chains to become truly sustainable with the minimum expectation …to maintain economic viability, while doing no harm to social or environmental systems" (p. 45). This definition is based on the Bruntland Commission's concept of economic, social and environmental performance over time (Brundtland Commission, 1987). In general, this paper

refers to sustainability in supply chains as research that goes beyond economic performance to include social and environmental.

The opportunity to be sustainable is enhanced with increased access to resources enabled by extended knowledge exploration and exploitation. When faced with reduced access to resources or scarce resources, open innovation is a means to extend the resource base while still providing the opportunity to create valuable returns to the firm. A firm's adoption of open innovation indicates that the firm is not just inwardly-focused but also recognizes the external market and is receptive to collaboration with partners in the supply chain network as a means to maintain access to resources. A premise of the current study follows that supply chains have a great potential and capacity for sustainability through employing open innovation. This is supported by supply chain management practices of integration, which involve crossing functional and organizational boundaries. Firms have recognized and built upon this foundational practice to become more open to sharing knowledge in order to create and capture value (Almirall and Casadesus-Masanell, 2010). Value capture, especially, is an important element of sustainability. In fact, companies across several industries increasingly have identified sustainability as a desired and necessary part of their strategic outlook. Nike, Best Buy and Yahoo, among others, collectively established GreenX, an Intellectual Property (IP) portal, to share, develop and promote innovation throughout their supply chains.

Many scholars (e.g. MacGregor, Espinach, Fontrodona, 2007; Nidumolu, Prahalad, Rangaswami, 2009; Carter and Easton, 2011) propose that companies espousing sustainability as part of their strategic direction will be in a better position to achieve competitive advantage. A high percentage of these companies also claim that innovation contributes to competitive advantage because it allows the company to better position itself for the dynamics of the market by combining technology and society needs continuously (Hall and Wagner, 2012). In fact, innovation has been recognized and explored extensively as a key component of a firm's ability to establish and to sustain competitive advantage (Boons and Lüdeke-Freund, 2013). For example, Nestlé's dairy supplier program RISE (Response-Inducing Sustainability Evaluation (RISE), is part of a more encompassing Supplier Code applied to the global based company. RISE is an assessment tool designed to encourage suppliers (primarily farmers) to continually identify potential areas of strengths and weaknesses associated with the social, economic and environmental dimensions of sustainability. One of the outcomes of the program has been increased innovation among the suppliers leading to greater social quality as well as economic and environmental. This topic has undoubtedly generated a range of important papers that explore the relationship between innovation and sustainability (e.g. Schaltegger et al., 2012; Carnovale and Yeniyurt, 2015).

Research design

This research applies a systematic review approach to identify the dimensions and antecedents of innovation and sustainable supply chain networks (especially in light of open innovation) (Tranfield, Denyer, Smart, 2003). In order to reduce bias in the research, the following steps were taken: the study searches two databases, builds on feedback from open discussion with experts at an academic conference, and initially avoided limiting itself to specific publications. The steps in the systematic review process are outlined in detail below.

Locating Articles

A systematic literature search of databases should result in a complete list as possible of relevant literature while keeping the irrelevant hits low (Duff, 1996). In order to limit bias, an initial unrestricted search was conducted on two databases: Web of Science and Google Scholar. These databases were selected as both Web of Science and Google Scholar allow researchers to search many sources, including peer-reviewed papers, theses, books, abstracts, and articles

from both academic and professional organizations and publishers. These databases thus have some of the largest repositories of business research and have been previously used in literature reviews.

The development of key word searches was an iterative process. The researchers first employed a brain storming technique and then used a snowballing process to add keywords to the search as they were discovered in the literature. These additional keywords were added until a point of saturation was reached, where no new keywords or articles were identified. The final list of keywords used is identified in Table 1.

Table 1 - Search strings for database search

Web of Science Key word strings	*TS = "open innovation" OR "sustainable supply chain" OR "green supply chain" "networks" OR "sustainability" TI="Supply chain" AND "Innovation"*
Google Scholar Key word strings	*"open innovation" OR "sustainable supply chain" OR "green supply chain" "networks" OR "sustainability" AND "Supply chain" AND "Innovation"*
Journal strings	*"Industrial Marketing Management" OR "R and D Management" OR "International Journal of Operations and Production Management" OR "International Small Business Journal" OR "Journal of Business Research" OR "International Journal of Management Reviews" OR "California Management Review" OR "Decision Sciences" OR "Journal of Small Business Management" OR "Journal of Supply Chain Management" OR "Journal of Business Logistics" OR "Management Science" OR "Organization Science" OR "Business and Society" OR "Transportation Journal" OR "Academy of Management Perspectives" OR "Academy of Management Review" OR "Journal of Business Venturing" OR "European Management Review" OR "Organization Studies" OR "Strategic Organization" OR "Journal of Operations Management"*
Notes:	*TI: Title Search, TS: Topic Search*

Articles selection and evaluation

The electronic search process resulted in the identification of 2,825 articles from Web of Science and 36,800 articles from Google Scholar, 39.625 articles total. In spite of the different approaches and vast difference in articles located, there was considerable overlap between the two sources – an indication for consistency across the search strings. However, due to the vast amount of journals pooled, a list of scholarly journals that routinely publish sustainable supply chain and innovation related articles was generated through discussions with experts in the field at an academic conference in order to further narrow the scope of the search. Further, the review panel felt that the articles needed to be limited to relevant journals in order to provide a better pool of peer-reviewed "good studies" (Tranfield et al. 2003) before moving to data abstraction for final analysis.

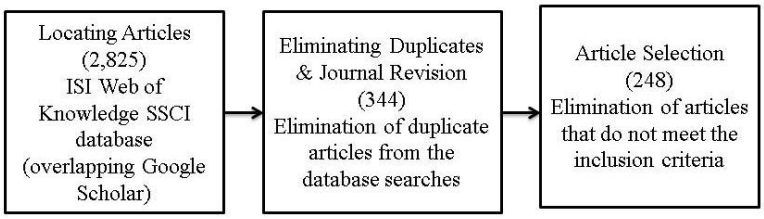


Figure 1 - Article Selection Process

Inclusion criteria were built based on discussions among the authors. Based on a review of extended abstracts collected from the articles, the authors determined one main inclusion criterion and one minor one. First, the authors contended that all the articles must demonstrate either a focus on sustainability or innovation (the inclusion of the keyword supply chain was

already a search criteria). Second, the authors excluded any articles not in English.

Analysis and Synthesis of Articles

For the analysis, all 248 article abstracts were entered into an Excel spreadsheet and then were uploaded into QDA (Qualitative Data Analysis Software). They were then coded and analyzed based on titles and abstracts with no reference to their publication outlets. Coding categories were developed to code for keywords, theories and methodologies. Eight methodologies, including structural equation modeling, regression, modeling, literature review, business model, qualitative, case study, and experimental emerged. Further, ten key words emerged including: innovation, open innovation, sustainability, supply chain, sustainable supply chain, networks, service, sustainable entrepreneurship, green, and entrepreneur. Coded keywords were then synthesized in order to elevate the abstraction of the framework (Durach, Wieland, Machuca, 2015). Because the reviewed literature did not overlap between sustainability and open innovation topics, it was more amenable to an interpretive synthesis to build higher order constructs and relationships between those constructs conceptually (Rousseau, Manning, Denyer, 2008).

Results

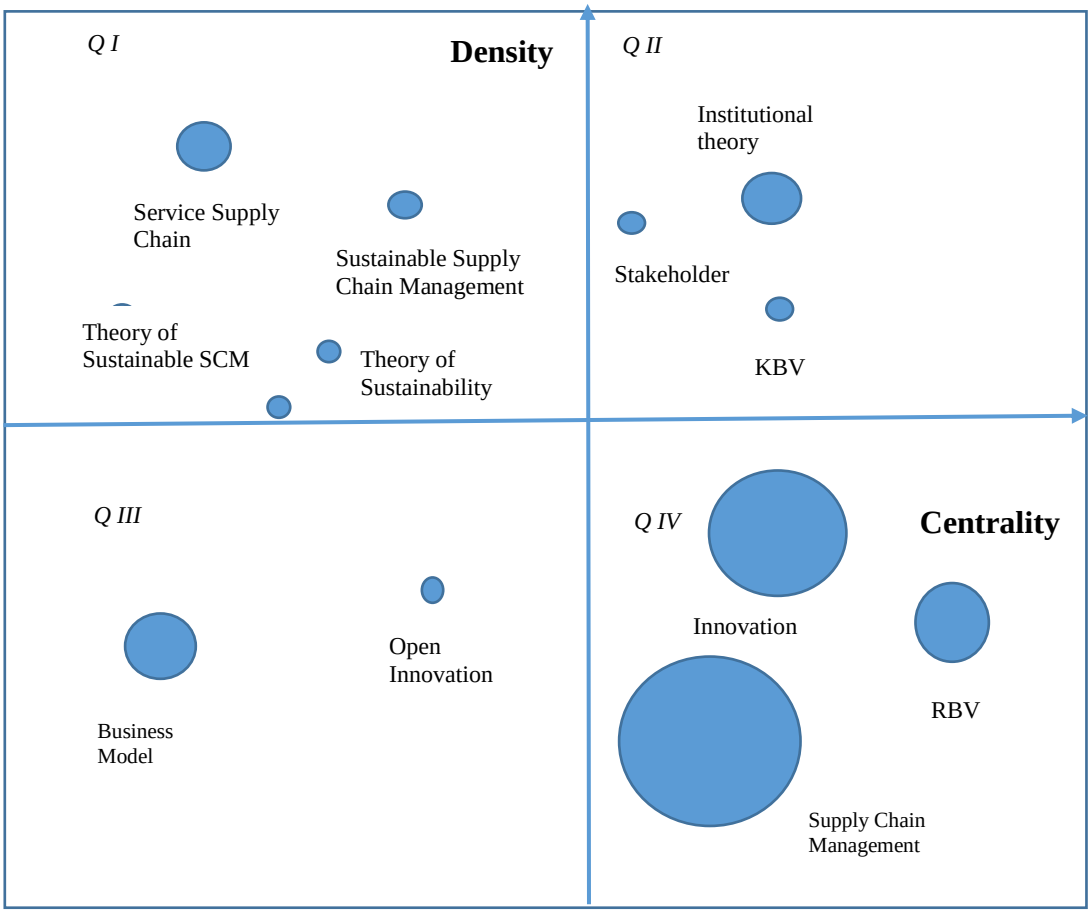
Using the code co-occurrence tool, information about the proximity of codes within the abstracts was analysis to explore potential relationships among abstracts as well as between abstracts. The themes are mapped in Figure 2. The keywords with high frequency represent particular research topics while a cluster of keywords that form a pattern is a research area. In addition, the size of the circles represents the frequency of the concept in the abstracts and a proxy measure of the strength of the respective concept in research.

A further mapping of the major themes is highlighted in Figure 2. For the preliminary analysis, only a few representative concepts are mapped to provide an overview of the different research areas and potential for further study. These are mapped into quadrants outlined in Figure 2. Figure 2 highlights *density* and *centrality* on the x- and y-axis, respectively. Density is the strength of the links that tie the keywords together. Density is the measure of the theme's development. The higher the density, the more coherent is the thematic cluster. Therefore, the y-axis (Density) represents the strength of development of the particular theme.

Centrality is the degree of interaction of a theme with other themes within the network of the keywords. Essentially, centrality represents the interaction and strength of the interaction to each other. The higher the number and proximity of a theme to other themes, the more central the theme or the more important is the theme to the development of the research field. This approach is adapted from Liu, Goncalves, Ferreira, Xiao, Hosio, Kostakos (2014). A description of the keywords and placement within the four quadrants follows:

- *Quadrant I* (top-left): These themes are not very well developed; they may have little interest to the research field outside of their particular area currently. In fact, they may represent emerging themes (e.g. theory of sustainable supply chain management).
- *Quadrant II* (top-right): These themes are internally well structured and indicate high activity research (e.g. institutional theory). However, their connections to other areas are relatively specialized and may not be valuable to the overall research field (e.g. stakeholder theory).
- *Quadrant III* (bottom-left): The main research in these is not well developed. However, they have considerable significance to the research area if a solid link is established (e.g. open innovation).
- *Quadrant IV* (bottom-right): These are themes that are well represented and core to the research field (e.g. RBV, supply chain management).

Figure 2: Quadrants (Adapted from: Liu et al., 2014)



Discussion

This abstract review points to some areas for a subsequent literature review. The ultimate objective is to contribute to academia and practice by synthesising extant literature which examines whether and how firms within a supply network leverage innovation to enhance their sustainability. A subsequent descriptive and thematic analysis offered deeper insights into the varying concepts and perceptions of the evolving nature of collaboration among organizations within the supply chain network. Given the concept of open innovation and the business model it imposes upon supply chain management, the nature of integration and collaboration may change thereby provoking new conceptual development. A discussion will also prompt the exploration of supply chain theory, which would include sustainability.

Open Innovation for Sustainable Supply Chain Management: A Research Agenda

There is abundant research on sustainable supply chain management and innovation independently, but very little which investigates how open innovation is implemented as a practice within supply chain management. Further, the abstracts and papers reviewed indicate the firm perspective and do not address the different levels associated with the *interfirm* approach associated with open innovation supply chain management. There could be, for example, different innovation incentives or characteristics at the different positions in the supply chain. Upstream may be more oriented towards product development, cost issues and IP. The downstream – closer to customer – may be associated with crowd sourcing and more into the customer domain. Accordingly, the interaction among the differences may affect the overall ability to achieve competitive advantage for a singular firm depending upon their

respective position. Arguably, a majority of companies would place the responsibility in the procurement/sourcing functions, which would have a cross-functional approach of coordinated strategy, governance and some collaboration across partners (still an economic-dominated model). A more integrated approach would combine the supply chain functions with pricing, marketing, quality and innovation. Sustainability in this sense may be defined by the customers or buyers. While many general theories provide insights into the thematic overlaps in the systematic literature review, it is possible that a mid-range approach within the scope of the popular general theories that would provide more explorative support for the adoption of open innovation in sustainable supply chain networks.

Open Innovation for Sustainable Supply Chain Management - Sustainability Theory Lens

There are some attempts to develop a theory of sustainable supply chain management from previous studies of 'green' supply chains (e.g. Carter and Rogers, 2008; Seuring and Müller, 2008; Pagell and Wu, 2009) but these developments are not consistent or they have not been taken up consistently. This inconsistency may be indicative of theory development in the initial stages but is also a result of a lack of defined concepts and measures associated with sustainability in the supply chain.

Moreover, theory development at this point is at the macro level in terms of examining identifying the general issues and relationships of concepts. Very few, studies examine the relationship between open innovation and sustainability within the supply chain network and *how* one may influence the other in enhancing competitive advantage. SCM and open innovation, however, are represented in the research to some degree, but not necessarily as conceptual or theoretical issues (Inauen and Schenker-Wicki, 2012). Open innovation provides the opportunity for a firm to outsource sustainability innovations to a third-party provider, Pagell and Wu (2009) theory of supply chain management indicates that supplier continuity is a differentiator for sustainable supply chain growth with third party providers. The abstracts and papers reviewed point to a more managerial focus providing opportunities to explore open innovation for sustainable supply chain management from a mid-range theoretical perspective to explore the following research question:

RQ: "How does a 3rd party open innovation provider align with the focal firm for sustainable supply chain management innovation?"

Open Innovation for Sustainable Supply Chain Management – A Network View

While innovation has been predominantly explored through a green and sustainable supply chain management has only begun to adopt a network view of environmental innovation activities (Dai, Cantor, Montabon, 2015). Carter and Rogers (2008) indicate the need to integrate population ecology, resource dependence, transaction cost economics, and a resource-based view of the firm, but fail to recognize the network of organizations that are necessary to implement environmental innovation. However, later exploratory research indicated the need to utilize network theory to explore the inter-firm, inter-functional approach necessary for environmental innovations to be extended throughout the supply chain. The diffusion of innovation has been a network phenomenon since the phrase was coined by Rogers (2008), this networked action of innovation diffusion and adoption is not only necessary for incremental innovations but also for radical environmental innovations that will be adopted throughout a supply chain. The radical environmental innovations that get adopted in a supply chain network are dependent on supply chain integration (with both suppliers and customers) in order to drive a competitive advantage (Dai et al. 2015). Open innovation provides a third party the opportunity to more quickly test and assimilate environmental innovations into slow moving and often slow to change larger organizations. If explored in a sustainable supply chain context, the adoption of both incremental and radical innovations has potential to function differently

within an open innovation context where third party integration is already in place. Thus, a research questions at the intersection open innovation and sustainable supply chain networks is as follows:
RQ: "How does open innovation impact the adoption and diffusion of environmental innovations in a sustainable supply chain network?"

Conclusion
This paper makes two key contributions: from an extensive literature review it identifies and ties together the business model approach of open innovation to supply chain sustainability theoretical development. This addresses the question of *how* open innovation can be used to develop sustainability in the supply chain. Second, it identifies research opportunities by outlining the 'common' concepts and relationships from the literature.

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The sense and non-sense of (early) supplier involvement in NPD: a meta-analysis

Robert Suurmond[a], Finn Wynstra[b], and Jan Dul[b]

a) Rotterdam School of Management, Erasmus University.
Mandeville Building, (T)09-47
Burgemeester Oudlaan 50
3000 DR Rotterdam
suurmond@rsm.nl
+31 10 408 1559

b) Idem.

The sense and non-sense of (early) supplier involvement in NPD: a meta-analysis

Abstract

In this paper, we study supplier involvement in New Product Development (NPD). Prior research presents mixed empirical outcomes of supplier involvement and, in general, does not differentiate between NPD efficiency and NPD effectiveness. We aim to reconcile these issues by reconceptualizing the phenomenon along the dimensions of extensive and early supplier involvement and by meta-analytically assessing their effects on NPD efficiency and effectiveness, respectively. We conduct a systematic review and meta-analysis of the empirical literature from more than 4,315 unique projects to understand to what extent and when suppliers should be involved to achieve better NPD performance. Our findings show that more extensive supplier involvement, through delegation of design labor and tasks, contributes to both NPD efficiency and NPD effectiveness. On the other hand, earlier involvement of suppliers as such, for example in idea generation or concept development, does not contribute to product effectiveness but improves project efficiency somewhat. Hence, under constrained resources, managers can design more effective product development strategies by unraveling supplier involvement into the extent and the moment of the supplier's participation and selecting the most optimal strategy for achieving higher efficiency or effectiveness. In conclusion, this paper advances theorization on supplier involvement in NPD by carefully unraveling the construct into its constituent dimensions and analyzing their effects on NPD efficiency and effectiveness.

Keywords: Supplier Involvement, Meta-Analysis, Innovation

Competitive Paper

Introduction

Product innovation no longer takes place within the boundaries of the firm, but increasingly relies on others as external sources of knowledge (Un et al., 2010; von Hippel, 2007). Prominently featured among these external knowledge sources are a firm's suppliers. For example, automotive companies have increasingly turned to their first-tier suppliers to develop parts and components for new car models (Clark, 1989; Clark and Fujimoto, 1991; Johnsen, 2009). This idea of integrating upstream supply chain partners in product development has become known as 'Early Supplier Involvement'—which refers to buyer-supplier collaborations in developing new product ideas and concepts and to suppliers' execution of product development tasks (Monczka et al., 2000; Van Echtelt et al., 2008). For example, Boeing is collaborating with car seat manufacturer Adient to develop and manufacture seats for airlines, in order to cut delays in airplane delivery times (Hepher, 2018).

However, there are some puzzling issues in the literature that we aim to reconcile in this paper. Supplier involvement does not always lead to its intended effects (Eisenhardt and Tabrizi, 1995; Hartley et al., 1997; Hong et al., 2009). For example, Eisenhardt and Tabrizi (1995) show that early supplier involvement only contributes to project speed in mature industries. Furthermore, the extant literature uses a wide variety of terminology to describe the phenomenon of supplier involvement and it is not always easy to distinguish precisely between various aspects of supplier involvement and NPD performance. For example, Johnsen (2009, p. 187) writes that: "early and extensive supplier involvement in NPD projects has the potential to improve NPD effectiveness and efficiency". So which is it? We submit that supplier involvement and its effect on NPD performance can be more accurately understood by carefully unraveling the multidimensional nature of both constructs.

First, supplier involvement has been studied as the *extensive* (Clark, 1989; Wynstra et al., 2012) and as the *early* (LaBahn and Krapfel, 2000; McIvor and Humphreys, 2004; O'Neal, 1993) involvement of suppliers in developing new products (Johnsen, 2009). These two

dimensions of supplier involvement—as we will review next—have different historical and theoretical roots and may lead to different NPD outcomes.

Second, early research on supplier involvement mainly analyzed the impact on NPD efficiency, such as time-to-market and development cost (Brown and Eisenhardt, 1995; Clark, 1989) but later research also examined the effects on NPD effectiveness, such as product quality and market share (Hoegl and Wagner, 2005; Petersen et al., 2003; Swink, 1999). The extant literature treats the effects of supplier involvement on NPD efficiency and effectiveness as essentially the same (Hoegl and Wagner, 2005; Johnsen, 2009; Primo and Amundson, 2002). However, different streams of research on product development focus on NPD efficiency or effectiveness, respectively, and certain product development practices, such as supplier involvement, may affect just one aspect of NPD performance (Brown and Eisenhardt, 1995; Eisenhardt and Tabrizi, 1995).

In this paper, we employ meta-analysis to pool empirical evidence from prior research and to provide an integrative perspective on the relationship between supplier involvement and NPD performance. With the current empirical evidence painting a blurred image (Johnsen, 2009) and case studies showing that achieving successful supplier involvement is difficult (Bonaccorsi and Lipparini, 1994; Wynstra and Ten Pierick, 2000), managerial practice cannot be properly advised. With this study, we advance a more complete conceptualization of supplier involvement to inform scholarly theorization and managerial understanding.

Theory

Starting with the work of Clark (and others), the phenomenon of supplier involvement was sparked by the observation that Japanese automotive companies outperform their Western counterparts in time-to-market and development cost (Clark, 1989; Clark and Fujimoto, 1991; Iansiti and Clark, 1994). The explanation for this observed difference was found in the extensive use of supplier engineers on OEM's product development projects. That is, the managerial practice of supplier involvement was discovered by academia due to a performance gap in New Product Development (NPD) performance. Many other comparative studies were conducted in the early years (e.g., Liker et al., 1996). Later studies started to differentiate between *extensive* and *early* supplier involvement (Bidault et al., 1998a; Hartley et al., 1997; see also Johnsen, 2009). Rather than the extensive use of supplier engineers and the outsourcing of design tasks to suppliers, involvement of suppliers in (very) early phases of new product development allows ideas and new product concepts to flow freely between the buyer and its suppliers (Handfield et al., 1999; Parker et al., 2008). The terminology Early Supplier Involvement has become ubiquitous, as evidenced by book (chapter) titles and many articles (Dowlatshahi, 1998; LaBahn and Krapfel, 2000; McIvor and Humphreys, 2004; O'Neal, 1993; Zsidisin and Smith, 2005). The two dimensions of involvement —extensive and early—have been used interchangeably, are discussed using varying terminology, and are often not hypothesized to differentially affect NPD performance (Dowlatshahi, 1998; Hartley et al., 1997; Koufteros et al., 2010, 2007).

In the next sections, we therefore disentangle the two dimensions of supplier involvement—extent and moment—and develop hypotheses for their relationships to NPD performance. For present purposes, we differentiate between NPD performance as the success of the project and the success of the product, which are naturally related but not quite the same. (Brown and Eisenhardt, 1995; Hoegl and Wagner, 2005). NPD efficiency refers to the adherence to project targets and the use of fewer project resources such as financial resources and time (Hoegl and Wagner, 2005). In contrast, NPD effectiveness refers to the resulting product's quality and economic success (Hoegl and Wagner, 2005; Olson et al., 1995).

Extent of Supplier Involvement

Extent of supplier involvement refers to the division of labor and tasks between the buyer and suppliers as measured by supplier design responsibility (Azadegan and Dooley, 2010; Hartley et al., 1997; Van Echtelt et al., 2008; Wynstra et al., 2012). Outsourcing part of the design and development work to suppliers, presuming they already perform manufacturing tasks for similar components/products, increases efficiency because OEM's can save on development cost by reducing (in-house) expenditure of man-hours and can reach faster time-to-market by concurrent engineering (Eisenhardt and Tabrizi, 1995; Eppinger et al., 1994). In particular, involving suppliers in this way allows the buyer to leverage their development capabilities to its advantage.

The expected effect of extent of supplier involvement on NPD performance is highly grounded in practical observations rather than hypothesized from a (grand) theoretical foundation. For example, the observed gap in NPD efficiency between Japanese and US automakers sparked a large stream of research on supplier involvement (Clark, 1989; Clark and Fujimoto, 1991; Liker et al., 1996). The phenomenon of supplier involvement therefore represents a 'theory-in-use' or 'technological rule' (Argyris and Schon, 1974; van Aken, 2004). In particular, the theory accepted in practice, derived from the outperforming Japanese automotive companies, reads something like: 'if you want to achieve faster time-to-market and lower development cost in NPD, you should involve your suppliers extensively by delegating development labor and tasks'.

By relying on suppliers for the development of new parts, components, or (sub-)systems, buyers can leverage their suppliers' knowledge, technology, and development capabilities. Delegating design and development of core components to suppliers is in part about outsourcing the design work itself, which is more efficient than conducting it in-house, in particular with highly specialized and (technologically) capable suppliers (Clark, 1989; Iansiti and Clark, 1994). Furthermore, the buying firm is typically not interested in acquiring knowledge, but rather in applying it for the specific purpose of developing a new product (Grant and Baden-Fuller, 2004). A higher extent of supplier involvement, with substantial supplier responsibility for developing detailed specifications for a component, allows the buyer to leverage supplier development capabilities and efficiently translate the supplier's knowledge and expertise into product specifications and component blueprints (Koufteros et al., 2007; LaBahn and Krapfel, 2000).

Note that many empirical studies on extent of supplier involvement—and more importantly, their theoretical argumentation—find effects on NPD efficiency: faster time-to-market (Callahan and Moretton, 2001; Clark, 1989), lower development cost (Hoegl and Wagner, 2005), and fewer in-house man-hours spent on development (Clark, 1989). All early studies from the 1980s and 1990s on supplier involvement focus on NPD efficiency (see Johnsen, 2009, p. 188–189, Tables 1 and 2). As delegating design and development to suppliers reduces in-house expenditures on development and leverages the supplier's development capabilities, we develop the following hypothesis:

H1: *A higher extent of supplier involvement is positively related to NPD efficiency.*

Moment of Supplier Involvement

Another stream of literature has focused instead on what has become known as 'Early Supplier Involvement'. While this terminology has a broad connotation and has been used to refer to a range of supplier involvement practices (Bidault et al., 1998b; Dowlatshahi, 1998; LaBahn and Krapfel, 2000; McIvor and Humphreys, 2004; O'Neal, 1993), it is operationalized in the empirical literature by one specific measure. The *moment of supplier involvement* is the earliest of the five phases of product development, initially proposed by Handfield et al. (1999),

in which a supplier is involved. In studies on the *timing* of supplier integration (Hartley et al., 1997; Parker et al., 2008) or simply *early* supplier involvement (Dowlatshahi, 1998; LaBahn and Krapfel, 2000; Zsidisin and Smith, 2005), the exact same or highly similar conceptualization of phases of product development is employed.

Early involvement allows buyers to have informal and social interaction with their suppliers during idea generation and product concept development. The transfer of (organizational) knowledge from suppliers to buyers for the specific purpose of developing a new product is strengthened by social interaction between individuals (Fey and Birkinshaw, 2005; Nonaka, 1994). Upstream supply chain partners are recognized as a valuable external source of knowledge (Un et al., 2010) and involving them early allows the buyer to tap into suppliers' ideas, product concepts, and technologies.

Hence, buyer's product ideas and concepts may benefit from the early involvement of suppliers, ultimately leading to better commercialized products (Koufteros et al., 2010), higher product quality (Yan and Kull, 2015), and lower product costs or better profit margins (Chien and Chen, 2010). An earlier moment of supplier involvement is therefore expected to contribute to NPD effectiveness—rather than efficiency. Supplier's ideas and suggestions may result in better product concepts and designs that ultimately proof valuable in the market. Again, the theoretical foundation for expecting this relationship is deeply grounded in practical observations and is analogous to a theory-in-use or technological rule: 'if you want to achieve better products, you should involve your suppliers in earlier stages of new product development'. Based on the perspective of social interaction in knowledge transfer (Fey and Birkinshaw, 2005; Nonaka, 1994), this can also be effectively translated into the following hypothesis:

H2*: An earlier moment of supplier involvement is positively related to NPD effectiveness.*

Conceptual Model

Based on the hypotheses introduced above, we can now derive the following conceptual model, see Figure 1. The model depicts the expected effects of more extensive and earlier involvement of suppliers on NPD efficiency and effectiveness, respectively. The model also depicts that, as some of the literature suggest, the dimensions can affect both NPD efficiency and effectiveness, which we discuss in detail next to derive further hypotheses. Furthermore, the model shows that the dimensions of involvement are interrelated, which we discuss thereafter.

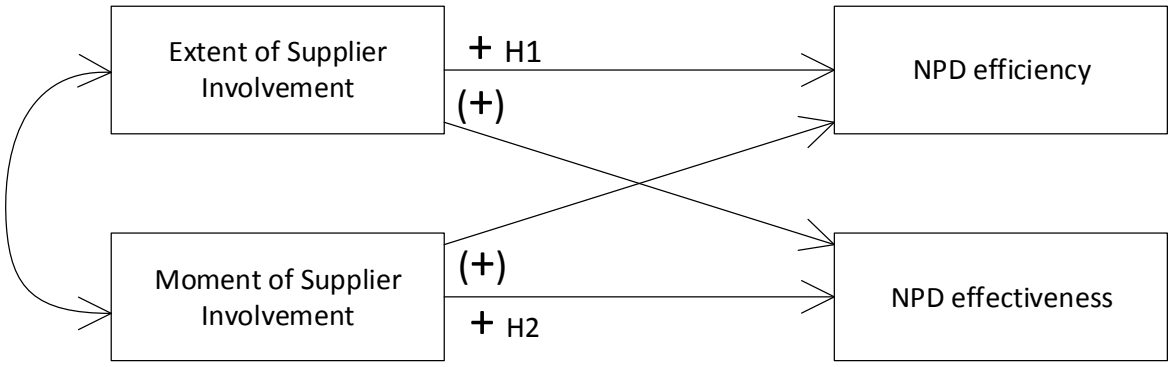

Figure 1. Conceptual Model.

NPD Efficiency and Effectiveness

First, as already briefly highlighted, a number of studies also examine the effect of delegating design and development responsibility to suppliers on product quality, market

success, and other aspects of NPD effectiveness. Most of these studies invoke the same argumentation for expecting positive effects of supplier involvement on NPD efficiency as effectiveness (Hoegl and Wagner, 2005; Johnsen, 2009; Primo and Amundson, 2002; Ragatz et al., 2002). When the manufacturing of critical product components is already outsourced to suppliers, an equally large role of suppliers in developing new components leads to the more effective integration of their (operational) knowledge in the component specifications. However, it is not exactly clear how well developed components lead to better products. In fact, coordinating disconnected sub-projects and integrating these effectively into new products can be quite challenging (Hong and Hartley, 2011; Lakemond et al., 2006). Still, in buyer-supplier collaborations for the development of new components, knowledge may also spill-over to the development of the overall product through social interaction (Nonaka, 1994) between buyer and supplier engineers. Therefore, we expect the extent of supplier involvement to also positively impact NPD effectiveness, though this effect can be smaller than its effect on NPD efficiency.

H3a: *The extent of supplier involvement is positively related to NPD effectiveness but* ***b)*** *this relationship is smaller than its effect on NPD efficiency.*

Second, several studies examine the effect of the moment of supplier involvement on NPD efficiency (e.g., Eisenhardt and Tabrizi, 1995; Koufteros et al., 2010; Laseter and Ramdas, 2002; Yan and Kull, 2015). If suppliers are involved earlier, technical and manufacturability issues can be discovered sooner, which makes them easier to fix (Eisenhardt and Tabrizi, 1995; Swink, 1999). Early discovery of potential problems with product concepts or their technical execution potentially prevents late—hence costly and difficult—changes to the product specifications or delays in operations ramp-up (Swink, 1999). On the other hand, involving suppliers early to discuss new product ideas and concepts may add substantially to project duration and can be costly to manage (Hartley et al., 1997; Wynstra et al., 2012). Thus, to the extent that late discovery of problems can be prevented, earlier supplier involvement may also positively contribute to NPD efficiency, but most likely less than to NPD effectiveness.

H4.a: *The moment of supplier involvement is positively related to NPD efficiency but* ***b)*** *this effect is smaller than its effect on NPD effectiveness.*

Interrelationship between Extent and Moment of Supplier Involvement

So far, we have discussed the extent and the moment of supplier involvement separately. However, despite the different theoretical and historical roots of these dimensions, some scholars have treated them as interrelated or have not precisely distinguished between the two (Jayaram, 2008; Jean et al., 2014). Some studies have argued that the timing of a supplier's involvement should be based on the level of design responsibility it receives (Bidault et al., 1998a; Monczka et al., 2000). In particular, when a supplier assumes a large role in developing components, it should also be involved in relatively earlier stages of the project, for example using a project integration approach (Lakemond et al., 2006). This suggests a perfect correlation between the extent and the moment of supplier involvement.

However, not all suppliers should be involved extensively ánd early per se. Given the aim of this review to develop a more complete understanding of the supplier involvement phenomenon, we aim to analyze this interrelationship empirically. Based on the discussion above, we expect that there will be a positive interrelationship between the extent and the moment of supplier involvement ($r \neq 0$), but that this relationship will not be perfect ($r < 1$).

Methods

We employ meta-analysis as an empirical research method to test our hypotheses. Meta-analysis is a research methodology and statistical technique for integrating previous empirical findings, pooling the data, and summarizing and exploring the evidence. Thus, by relying on previous research for the data, meta-analysis can achieve a large number of observations, much larger than any single study in the sample achieves. For the sake of brevity, we present the methodology for sampling and selecting studies in Figure 2.

We conducted a key-word search in major databases to discover a wide range of studies on supplier involvement and added studies from a few other sources. We then filtered these studies based on titles and abstracts and excluded irrelevant studies (not about supplier involvement) and all qualitative inquiries (case studies, etc). Finally, based on an analysis of the full text of the remaining papers, we included 27 studies, with 29 independent samples, in the meta-analysis. These studies were selected because they include constructs and measures that match our definitions—see Appendix A—and present the results using effect sizes.

Data extraction

The main parameter of interest from the primary studies is the effect sizes. As most empirical evidence in this field is gathered using survey research, typical effect sizes are the correlation coefficient r and the regression coefficient β (Lipsey and Wilson, 2001). Along with the correlation coefficient, the sample size of each study was extracted, which is used to estimate sampling error and weigh the effect sizes accordingly. Based on the information available from the primary studies, we also coded the research methods and data collection. Specifically, we used dummy variables to code whether zero-order correlations or regression coefficients were reported and whether a single or multiple sources (informants) were used to gather data. Furthermore, we coded the data collection year or publication year. We use these control variables to examine whether research characteristics explain the observed heterogeneity in effect sizes.

Data analysis

We employ meta-analysis and meta-regression (MARA) to statistically analyze the effects of supplier involvement on NPD performance (Hedges and Olkin, 1985). First, we conduct random-effects meta-analysis to estimate the average effect of each dimension of supplier involvement on NPD performance and on NPD efficiency and effectiveness respectively. When multiple effect sizes are available from a single sample, the interdependency between these effects are modelled in specifying the random effects models. Hence, effects from the same sample are clustered first into a composite, before including the cluster as a unit in the meta-analysis (Viechtbauer, 2010). However, they may be decomposed into separate effect sizes when they represent different relations in the model, e.g., different NPD outcomes.

If the average effects are heterogeneously distributed, meaning that the individual effects are estimates of different underlying true effects, a search for moderators can be conducted using meta-regression. To conduct meta-regression, we employ a weighted least squares (WLS) regression using mixed effect modelling (Geyskens et al., 2008; Lipsey and Wilson, 2001) of the reported effect size on a number of moderating variables, for example the research methodology control variables identified above. These moderators are thus operationalized to vary across studies and we use meta-regression to explore the between-study variance in effect sizes.

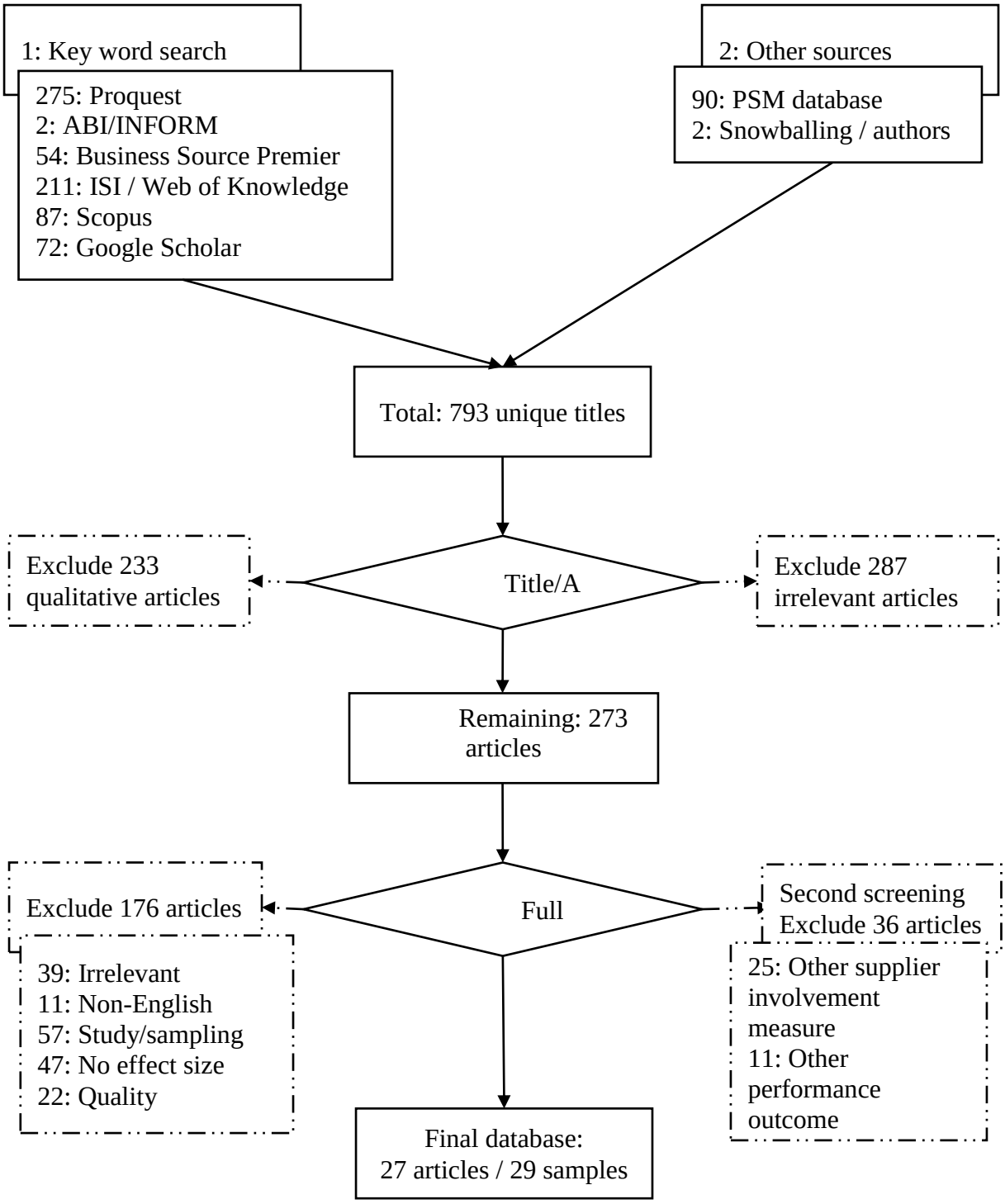

Figure 2. Sampling and selection of the literature.

Results

In this meta-analysis, we study the effect of the extent and the moment of supplier involvement on NPD efficiency and effectiveness. Therefore, we run a random effects model on the correlation coefficients between the two dimensions of supplier involvement and the two facets of NPD performance. The correlation coefficients originate from 27 primary studies (29 independent samples) and are based on a total sample size of 4,315 projects, with over 10,000 observed relations. The results from the main meta-analysis are presented in Table 1, which shows the findings of this meta-analysis for different subgroups—as in the model.

Table 1. Meta-analytical correlation coefficients

	k	N	r	95% CI	Cred Int	Q	Fn
Relationship with NPD performance							
Supplier Involvement	58 (29)	4,315	0.155	0.100; 0.209	-0.131; 0.441	183.26 *	5455
Extent of Involvement	41 (22)	3,691	0.190 [a]	0.121; 0.258	-0.107; 0.457	131.11 *	3496
Moment of Involvement	17 (10)	1,343	0.132 [a]	0.048; 0.214	-0.087; 0.339	46.07 *	202
Relationship with NPD efficiency							
Supplier Involvement	21 (18)	2,877	0.161	0.088; 0.233	-0.092; 0.395	51.72 *	563
Extent of Involvement (H1)	13 (12)	2,203	0.204 [b]	0.115; 0.290	-0.057; 0.439	33.81 *	321
Moment of Involvement (H4a)	8 (8)	976	0.114 [c]	0.010; 0.217	-0.095; 0.314	13.56	27
Relationship with NPD effectiveness							
Supplier Involvement	32 (20)	3,775	0.140	0.080; 0.200	-0.091; 0.358	94.99 *	1419
Extent of Involvement (H3a)	24 (16)	3,223	0.156 [b]	0.088; 0.223	-0.087; 0.381	66.91 *	972
Moment of Involvement (H2)	8 (6)	994	0.095 [c]	-0.015; 0.203	-0.130; 0.311	25.70 *	NA

*Note. k: number of effect sizes (number of independent samples). N: total number of observations. r: meta-analytical average correlation coefficient. 95% CI: 95% confidence interval. Cred Int: 80% credibility interval. Q: observed heterogeneity; the asterisk * indicates significant heterogeneity with p < 0.01. Fn = Rosenthal's failsafe N. a: difference between these correlation coefficients is significant at α = 0.10: $t_{(52)} = 1.865$, p = 0.069. b: difference between these correlation coefficients (H3b) is insignificant: $t_{(36)} = -1.224$, p = 0.229. c: difference between these correlation coefficients (H4b) is insignificant: $t_{(15)} = -1.214$, p = 0.245.*

Our findings show that extent of supplier involvement is positively related to NPD efficiency, in support of Hypothesis 1. As expected, delegating more responsibility for design and development tasks to suppliers is positively related to higher levels of efficiency in the NPD project, such as faster time-to-market and lower development cost.

Surprisingly, the results of the meta-analysis do not support Hypothesis 2: there is no positive relationship between earlier moment of supplier involvement and NPD effectiveness. That is, involving suppliers in earlier phases of the project, such as idea generation and concept development, does not lead to higher quality products or higher market shares.

The results additionally provide support for Hypothesis 3a: the extent of supplier involvement is also positively related to NPD effectiveness. That is, for projects in which a larger share of development responsibilities were delegated to suppliers, we observe higher product quality and market shares. We do not find support for H3b because extent of supplier involvement does not have a significantly higher effect on efficiency than on effectiveness, see Table 1 note b, while the difference is in the expected direction.

Our findings also provide support for Hypothesis 4a: the moment of supplier involvement is positively related to NPD efficiency. In other words, involving suppliers in earlier phases is related to faster time-to-market and lower development cost. We do not find support for H4b because moment of supplier involvement does not have a significantly higher effect on effectiveness than on efficiency, see Table 1 note c. In fact, the difference is in the

opposite direction and, as H2 is rejected, there is no positive contribution to effectiveness at all.

Meta-regression analysis

The results are confirmed by the meta-regression results presented in Table 2. In this analysis, all correlations between supplier involvement and NPD performance are included—as in the top line of Table 1—except the 'mixed' NPD performance category. We then perform a regression of these effects on several moderators. The moderators include a dummy variable for the dimensions of involvement (extent, moment) and a dummy variable for the facets of NPD performance (efficiency, effectiveness). Table 2 provides unstandardized regression coefficients with their 95% confidence intervals for each of the moderators.

The results in Table 2 shows that the extent of supplier involvement is more positively related to NPD performance than moment of supplier involvement. The two dimensions of supplier involvement have a differential effect on performance, because the effect of extent of involvement is typically larger and because moment of involvement does not affect NPD effectiveness. We furthermore find that effect sizes derived from partial correlations—hence, controlled for other variables—are typically smaller than zero-order correlations. The other moderators included in the model are not significant. Overall, we find that the heterogeneity in effect sizes, which is the cause of the reported mixed findings in the literature, can be explained—in part—by unraveling supplier involvement and its effects on NPD performance.

Table 2. Meta-regression: Relationship between supplier involvement and NPD performance

Moderator	Coefficient (95% CI)
Intercept	0.079 (-0.187; 0.345)
Extent of involvement (vs Moment)	*0.064 (-0.005; 0.134)†*
NPD effectiveness (vs. efficiency)	-0.036 (-0.103; 0.030)
Control variables	
Multiple sources	-0.004 (-0.113; 0.106)
Partial correlations	*-0.138 (-0.281; -0.004)†*
Year (1987 = 0)	0.003 (-0.008; 0.015)
Number of effect sizes (samples)	k = 53 (26)
Residual heterogeneity	$QE_{(df = 45)} = 122.104$, $p<0.001$
Test of moderators	$F_{(5, 47)} = 1.877$, $p = 0.116$

Note. † indicates significant moderation at α = 0.10.

Interrelationship between extent and moment of supplier involvement

We also collected data from three studies that report results for both dimensions of supplier involvement and additionally also include information for the relationship between the two dimensions (e.g., Koufteros et al., 2010). These studies, in summary, find that the two dimensions of involvement are positively related (r=0.415, $p<0.001$). The 95% confidence interval for this effect ranges from $r = 0.34$ to $r = 0.48$. This means that, on average, suppliers that are involved more extensively by partaking in design and development tasks are also involved in earlier stages. On the other hand, the correlation is only medium-sized (Cohen, 1977), so at least some suppliers assume significant development responsibility without necessarily being involved in the earliest stages of the overall project, or vice versa.

Discussion

In this study, we examined the effect of supplier involvement on New Product Development (NPD) performance through a meta-analysis. We systematically collected and reviewed the body of literature on this topic to create a better understanding of the concept of supplier involvement and the ways in which supplier involvement can improve NPD performance. While this research is not the first, or the last, to study supplier involvement in new product development, we provide new impetus for advancing scholarly theorization based on a careful examination of extensive and early supplier involvement and their effects on NPD efficiency and NPD effectiveness.

Theoretical implications

In this study, we unravel the two dimensions of supplier involvement and their effects on NPD efficiency and NPD effectiveness. Extant research under the 'Early Supplier Involvement' terminology has examined the effects of both extensive and early involvement of suppliers in developing new products (Bidault et al., 1998b; Hartley et al., 1997; Johnsen, 2009; Monczka et al., 2000). Our analyses show that the two dimensions affect NPD performance in different ways.

Extensive supplier involvement, in which responsibility for component design and development is delegated to suppliers, is related to higher levels of NPD efficiency and effectiveness. That is, projects in which suppliers contribute with engineering hours benefit with faster time-to-market and lower development cost (e.g., Clark, 1989), as well as higher quality and market advantage of the resulting product (e.g., Salvador and Villena, 2013). The effect on efficiency can be understood from the perspective of leveraging development capabilities and concurrent engineering (Clark, 1989; Eppinger et al., 1994; Koufteros et al., 2007): supplier knowledge and expertise is most efficiently translated into component specifications by allowing suppliers to co-develop these specifications. On the other hand, we also find that the end product itself can be improved through supplier integration in component development. First, superior components in itself may positively impact product quality and advantage. Secondly, supplier knowledge may spill-over to the development of the overall product specifications, which is strengthened by the collaborative nature of specification development, and ultimately results in better performing products (Hong and Hartley, 2011; Nonaka, 1994).

On the other hand, early supplier involvement, in which suppliers can contribute to product ideas and concepts, contributes to NPD efficiency but not effectiveness. That is, projects in which suppliers are involved earlier reach faster time-to-market and lower development cost, but do not ultimately produce better products. Suppliers' feedback on the buyer's initial idea and concept can quickly solve any technical issues that are costly to solve later in the project (Koufteros et al., 2010; Swink, 1999). Hence, when development risk is high, early supplier involvement—irrespective of the extensiveness—may lead to faster development time and lower cost (Wynstra and Ten Pierick, 2000).

We expected earlier supplier involvement to lead to better products because suppliers may have creative ideas and technical solutions, which, by integrating them early on in the buyer's idea generation and concept development stages, should produce higher quality products that are more attractive to consumers. There are some potential explanations for not finding this effect that future research may examine in more detail. First, suppliers may act opportunistically when buyers ask them to contribute ideas and concepts (Yan and Kull, 2015). For example, they may submit off-the-shelf solutions that appear innovative, but which are not technically superior to the buyer's current product. Second, it is possible that early involvement of component suppliers leads to better components, but that the overall system quality depends critically on the buyer's management of the difficult multi-party development project (Hong

and Hartley, 2011). For example, suppliers may propose suggestions for the buyer's product that enable higher performance of their components, but which are difficult to integrate into the overall product. If separate development tasks are relatively interdependent, earlier supplier involvement may contribute to the more efficient development of each of these tasks, but may hurt the integrated product's quality. Finally, suppliers may not have the relevant market intelligence to propose worthwhile ideas—after all, their business is selling components to business customers and not assembling or producing or marketing (consumer) end products.

Finally, we examined the interrelationship between the extent and the moment of supplier involvement. This relationship is positive, meaning that suppliers which assume responsibility for design and development are also involved earlier in the project, on average. However, the two dimensions of involvement are not correlated perfectly and should therefore be treated as two different aspects. For example, with the observed meta-analytic correlation coefficient ($r = 0.415$), the two dimensions of involvement should not be included in the same latent construct in a measurement model (Anderson and Gerbing, 1988). The extant research, on the other hand, has sometimes used the dimensions as interchangeable labels (Eisenhardt and Tabrizi, 1995; Jean et al., 2014; Primo and Amundson, 2002). As our findings show, distinguishing supplier involvement into extent and moment of involvement provides a more precise understanding of its effects on NPD efficiency and effectiveness. Thereby, it provides a more precise theorization of the phenomenon, resolving the apparent inconsistencies in the findings of empirical studies so far.

Practical implications

Building on the results from this review of the extant literature, we can derive the following practical recommendations. First, our findings allow us to develop more specific recommendations based on two distinct practices of supplier involvement. Managers that delegate design and development responsibility to suppliers achieve more efficient and effective product development. Managers that (only) involve suppliers early, may be able to achieve higher efficiency, but not better products. Secondly, if it is important to realize a fast time-to-market, both more extensive and earlier supplier involvement can help. However, if product quality or market performance are top priority, only delegating development responsibility to suppliers reaches the desired goals. This means that managers can strategically manage their supplier involvement: per component, per supplier, and per project.

Limitations

In this meta-analysis, the empirical evidence for testing the hypotheses comes from the underlying primary studies. This means that the limitations of these studies also affect the quality and validity of our findings (Bergh et al., 2016). In particular, concerns can be raised regarding endogeneity and common method bias (Ketchen et al., 2017; Roberts and Whited, 2013), as most of the data originates from cross-sectional studies with self-administered questionnaires and a single respondent for each case. Despite these weaknesses, there is some theoretical and empirical support to ground the conclusions. In particular, there is a (albeit conceptual) temporal difference between the decision to involve suppliers in NPD and the outcomes of the NPD effort, which suggests that causality cannot run in the opposite direction. Furthermore, there are no significant differences between single versus multiple informants per case, see Table 2.

The narrow focus of this meta-analysis allows us to reconceptualize supplier involvement at a detailed level. However, this also means that the set of available studies that capture either or both dimensions of supplier involvement as well as a relevant NPD outcome is more limited and somewhat smaller than in a typical meta-analysis (e.g., Zimmermann and Foerstl, 2014). Nonetheless, the amount of studies *per relationship* is somewhat comparable to

other recent meta-analyses in the field (Leuschner et al., 2014, 2013) and the total sample size in terms of development projects is much larger than primary empirical studies.

Future research

Beyond the direct suggestions from our findings as discussed in the theoretical implications, our review also allows us to describe some gaps in the literature. First, future research is required to understand how multiple suppliers can effectively be integrated in product development and how their interaction and interdependencies should be managed, as only a few studies have looked at this issue (e.g., Azadegan and Dooley, 2010; Hong and Hartley, 2011; Petersen et al., 2005). Other research has suggested that supplier capabilities or the prior history with the supplier are antecedents of supplier involvement, which is another promising avenue for research that is yet to be more fully explored (Carson, 2007; Hoegl and Wagner, 2005). Finally, most research on supplier involvement focusses on the effects on the buyer's NPD project and the final product, but it may be fruitful to also examine organizational level effects (e.g., Koufteros et al., 2007) or the effects on the supplier's and the component's performance (e.g., Jean et al., 2014; Takeishi, 2002).

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Appendix A: Concepts, Definitions and Exemplary Measurement Items.

Concept and definition	Exemplary measurement item(s)
Moment of supplier involvement: The phase of the buyer's NPD project in which the supplier(s) is/are first consulted.	**Timing**: *The earliest phase at which the supplier became involved in the NPD effort* (Parker et al., 2008, p. 76). **Timing**: *How much earlier than the start of production a supplier is involved in product development* (Laseter and Ramdas, 2002, p. 110).
Extent of supplier involvement: The degree to which the design and development tasks of the NPD project are delegated to suppliers.	**Supplier development responsibility**: *This supplier's level of design responsibility during the early/middle/late stages of the final product* (Azadegan and Dooley, 2010, p. 502). **Degree of outsourcing NPD**: *Percentage of total labor provided by outside suppliers/partners. The degree to which outsourcing design activities was used on the project* (Swink 1999, p. 700).
NPD Efficiency: the adherence to project targets and the use of fewer project resources such as financial resources and time	**Speed to market**: *Slower than industry norm/faster than industry norm. Much slower than we expected/much faster than we expected. Far behind our time goals/far ahead of our time goals. Slower than our typical product development time/faster than our typical product development time* (Zhao et al., 2014, p. 1062). **Development budget**: *For measuring project performance, we collected data .. from company records in terms of [among others] development budget: the percentage above/below budgeted development cost* (Hoegl & Wagner, 2005, p. 537). **Project performance:** *assessed using four commonly used items reflecting time-to-market, technical performance, unit manufacturing cost, and R&D budget as measured relative to goals* (Misha & Shah, 2009, p. 330).
NPD Effectiveness: the resulting product's quality and economic success	**Product Technical Performance** *was measured based on two items. We asked the NPD member to rate the durability and functionality of the new product compared with products designed by competitors* (Salvador and Villena, 2013, p. 95). **Market Success** *(compared to the industry, our product): Fit target customers better. Has more loyal customers. Generated more new customers. Was more successful in the marketplace.* (Koufteros et al., 2010, p. 66). **New Product Advantage:** Offered unique features or attributes to the customer. Was clearly superior in terms of meeting customers' needs. Offered higher quality—tighter specs, stronger, lasted longer, or more reliable. Had superior technical performance. (Potter and Lawson, 2013, p. 808)

Buyer-supplier co-development of business service specifications in the sourcing process

Robert Suurmond[a] and Finn Wynstra[b]

a) Rotterdam School of Management, Erasmus University.
Mandeville Building, (T)09-47
Burgemeester Oudlaan 50
3000 DR Rotterdam
suurmond@rsm.nl
+31 10 408 1559

b) Idem.

Buyer-supplier co-development of business service specifications in the sourcing process

Abstract

In this paper, we study the process of buying business services and the role that suppliers play in the specification and definition. Previous research argues that buyers of business services should involve (potential) suppliers in the sourcing process due to their superior knowledge and expertise. When buyers have routinely outsourced the production and delivery of important supporting services to external suppliers, they may also have lost the organizational capabilities and knowledge required for properly developing the service specifications to be procured. Hence, in order to benefit from the suppliers' experience, suppliers should be involved early and extensively in the development of service specifications. In this project, we collect data on specific buyer-supplier relationships for facility services (indirect, business-to-business services) with the help of an industry organization in The Netherlands. We study the effect of supplier involvement on business service quality as experienced by the buying firm. Results show that both earlier and more extensive involvement of suppliers in the sourcing process has a positive effect on business service quality. This study contributes to advancing our collective understanding of the role supplier involvement can play in buying business-to-business services.

Competitive Paper

Keywords: Supplier Involvement, Business-to-Business Services, Quality.

Introduction

Buying business services has been recognized as a difficult sourcing process, in part because buyers experience high levels of uncertainty (Wynstra et al., 2017), lack the required sourcing capabilities (Selviaridis et al., 2013), and may develop specifications over the course of the process (Selviaridis et al., 2011). Scholars have long argued that services differ from goods, because the former are characterized by intangibility, heterogeneity, inseparability, and perishability (IHIP, see e.g., Zeithaml Parasuraman, A. and Berry, L L., 1985). After substantial criticism, the service marketing literature has abandoned this old adagio and focused instead on the similarities between goods and services, in essence arguing that all 'products' fulfil a use value (Sampson and Froehle, 2009; Vargo and Lusch, 2004). Some maintain that services are produced and consumed simultaneously and in interaction with the customer (Grönroos, 2000) and that therefore, buying services is both more complex and important (Axelsson and Wynstra, 2002).

In this paper, we study a particular issue in buying business services that has received some attention in recent years: the development of service specifications in the sourcing process (Axelsson and Wynstra, 2002; Selviaridis et al., 2013, 2011). Determining the desired quality is increasingly difficult for services and requires specific (operational) service knowledge and expertise (Jackson et al., 1995). Since buyers rely increasingly on supplier capabilities for managing service operations, they lack specific know-how to define the service a priori. Hence, supplier involvement in this process may be required. Indeed, studies show that proper and clear business service specification is important and requires early involvement of providers in the purchasing process (Tate and Ellram, 2012; van der Valk and Rozemeijer, 2009).

In this research project, we study the effects of (early) supplier involvement in co-developing service specifications with the buyer on business service quality. We present empirical evidence from a sample of outsourced facility services, collected using a questionnaire among facility managers (buyers) in The Netherlands. This preliminary examination is part of a larger program to collect data from multiple sources on both sides of the dyads and for a larger sample.

In this paper, we first review the literature on business services and in particular on the specific characteristics of the sourcing process. Based on the knowledge based and capability views, we then develop theoretical hypotheses for testing. Next, we introduce the research design, data collection, measurement, and data analysis techniques. Finally, we present the initial findings from the research and discuss the results in light of the literature.

Theory

The literature on services has greatly expanded in recent years, with the promotion of new theories, views, and logics (Lindberg and Nordin, 2008; Lusch, 2011; Sampson and Froehle, 2009; Vargo and Lusch, 2004) and the increasing reputation of academic and professional journals (e.g., Journal of Service Research). Nonetheless, while services contribute the majority of value to the economy as measured by GDP and most employees effectively work in service businesses (The World Bank, 2015; Wynstra et al., 2017), research has not yet followed suit and is underrepresented in the scholarly literature. In this study, we focus on business services, which are delivered by organizations and purchased by other organizations (Axelsson and Wynstra, 2002), hence, we study services which are exchanged between organizations and—following Grönroos (2000)—are produced and consumed simultaneously in interaction between producer and (business) customer.

The sourcing process for business services is complex because purchasers may lack the 'sourcing capabilities' required for effective management (Axelsson et al., 2005) and may "know less than they buy" (Flowers, 2007; Hendry, 2002). As a result, identifying the business needs that drive sourcing request and translating that into purchasing specifications have been identified as challenges for the procurement function (Selviaridis et al., 2013). This points to potentially conflicting objectives. On the one hand, the success of business services depends critically on the development of proper and clear purchasing specifications (Tate and Ellram, 2012; van der Valk and Rozemeijer, 2009). On the other hand, the nature of business services and the potential lack of sourcing capabilities make developing specifications much more difficult (Lindberg and Nordin, 2008; Selviaridis et al., 2011).

When companies do not possess the required knowledge, expertise, or capabilities to effectively develop service specifications, they can leverage their network of partners (Un et al., 2010). In particular, research on the process of service specification development calls for the early involvement of suppliers and an extended role of (potential) suppliers in the definition of needs and specifications (Cho and Menor, 2010; Ellram and Tate, 2015; Selviaridis et al., 2013; van der Valk and Rozemeijer, 2009). In the regular purchasing process (e.g., van Weele, 2010), organizations first develop specifications for the required product or service, and afterwards select and contract an appropriate supplier. In the context of business services, as some of the literature suggests, this process may not be effective and suppliers may need to be involved in the (re)definition of needs and specifications over the course of the sourcing process.

The early and extensive involvement of suppliers in the sourcing process allows the buyer to leverage the suppliers' knowledge and capabilities (Clark, 1989; van der Valk and Rozemeijer, 2009). By leveraging the suppliers' knowledge, a buyer firm can tap into external sources of know-how related to the effective management of a business service. Knowledge in this context relates primarily to the deep understanding of the service (operations) management process and experience with running similar types of service systems (Grant, 1996). Furthermore, by leveraging the suppliers' capabilities, a buyer firm can also use the suppliers' expertise in managing the process of (re)defining business service specifications. Capabilities refer to the set(s) of resources and practices that enable firms to develop, sell, and implement service solutions that address the buyer's needs (Flowers, 2007).

Both leveraging knowledge and leveraging capabilities therefore contribute to the buyer's ability to design and develop business services in the sourcing process.

Two dimensions of supplier involvement in the early stages of the sourcing process play a role (Johnsen, 2009; Suurmond et al., 2018). Hence, we build on the literature on new product development to study supplier involvement (Clark, 1989; Handfield et al., 1999; Johnsen, 2009; Van Echtelt et al., 2008). First, the moment of supplier involvement refers to buyer-supplier collaborations in earlier phases of the sourcing process (Handfield et al., 1999; van der Valk and Rozemeijer, 2009). Second, the extent of supplier involvement refers to the degree of supplier contributions to and execution of sourcing tasks, in particular developing service specifications (Lichtenthaler and Lichtenthaler, 2009; Van Echtelt et al., 2008). These two dimensions of supplier involvement are quite distinct managerial processes for leveraging supplier knowledge and capabilities—which we will examine in closer detail in the development of our hypotheses.

As emphasized before, service is produced and consumed in interaction between provider and customer, so the quality of the business service is the customer's judgement of a provider's overall superiority or excellence (Parasuraman, et al., 1988). While product quality can sometimes be measured more objectively as the fit between the specifications and the delivered product, service quality is more elusive and captured by the match between customer expectations and customer experience of performance (for a review of this and other differences between conceptualizations of quality, see Golder et al., 2012). In particular, business service quality is examined as related to the potential quality, the hard and soft process quality, and the output quality (Gounaris, 2005). Other research shows that there is a link between higher levels of service quality and business performance, customer satisfaction, customer loyalty and retention and other relevant organizational outcomes (Cronin and Taylor, 1992; Parasuraman et al., 1988).

Table 1 and Figure 1 summarize our constructs, definitions, and relations.

Table 1. Key constructs and their definition.

CONSTRUCT	DEFINITION	REFERENCES
MOMENT OF SUPPLIER INVOLVEMENT	The first phase of the buyer's service sourcing process in which the supplier is involved	Handfield et al., (2000); Van der Valk and Rozemeijer, (2009)
EXTENT OF SUPPLIER INVOLVEMENT	The degree of the supplier's contribution to and execution of sourcing tasks	Van Echtelt et al., (2008); Lichtenthaler and Lichtenthaler (2009)
BUSINESS SERVICE QUALITY	The customer's judgement of a provider's overall excellence related to the aspects of potential quality, hard and soft process quality, and output quality.	Golder et al., (2012) Gounaris (2005) Parasuraman, et al. (1988)

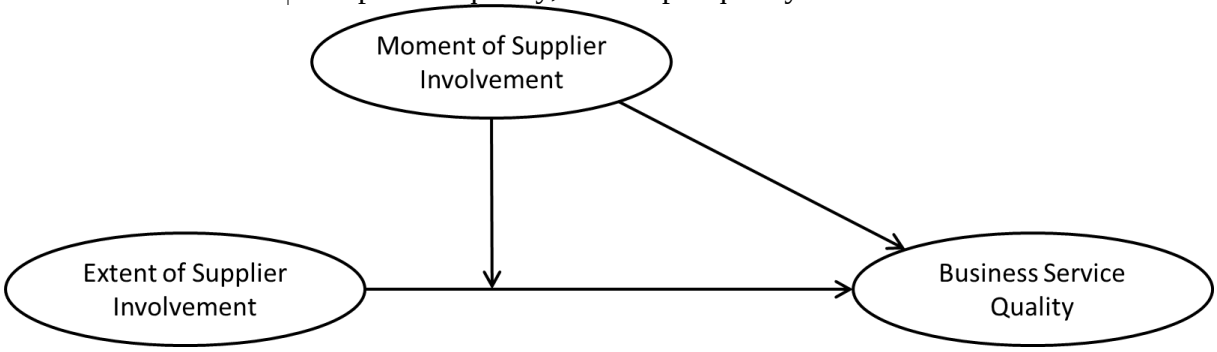

Figure 1. Conceptual model

Hypotheses development

The early involvement of suppliers in the sourcing process, i.e., before the specifications are frozen, allows a buyer to access knowledge and apply this in the shared 'service specification process'. As the success of business services is "primarily determined" during the development of service specifications (van der Valk and Rozemeijer, 2009, p. 6), early involvement of suppliers allows them to submit ideas and concepts for the business service that the buyer may not have thought about. As purchasers are not fully knowledgeable about the business needs (Flowers, 2007), involving suppliers which regularly fulfill said needs for other customers can improve buyer's ability to appropriately specify the service. An earlier moment of supplier involvement therefore provides the buyer with access to more know-how, which can be used to design and develop a better service. We expect that buyers are better able to set the appropriate specifications if they involve suppliers earlier in the sourcing process:

H1. *An earlier moment of supplier involvement has a positive effect on business service quality*

However, this still requires the buyer to leverage internal capabilities for the effective translation of supplier knowledge into purchasing requirements. Defining service quality cannot be done by the service buyer independently but should, instead, be guided by suppliers' superior knowledge of the possible solutions and expertise in how they have been used in similar contexts (van der Valk and Rozemeijer, 2009). Using a 'connecting capacity' or 'indirect capability' (Lichtenthaler and Lichtenthaler, 2009; Loasby, 1998), buyers can also leverage their suppliers capabilities themselves and integrate the supplier into the actual service sourcing process. This allows the buyer to use the suppliers' understanding of the service sourcing process and potentially make the supplier work in conjunction on some of the sourcing tasks. Hence, a higher extent of supplier involvement in the sourcing process enables buyers to more appropriately specify the business needs and specifications. We expect that the service will reach a higher quality if buyers co-develop the specifications of the service with their suppliers.

H2. *A higher extent of supplier involvement has a positive effect on business service quality*

Extensive supplier involvement, however, can only positively affect the performance of new services if the supplier is provided sufficient time to contribute with its relevant knowledge (Bidault et al., 1998; Handfield et al., 1999). Service specifications are becoming more firmly set over the course of the development project, with less to influence by the supplier in later stages. Leveraging the supplier's capability for developing service solutions is not immediate, but takes time. Therefore, we posit that the joint effect of extent of involvement and moment of involvement is larger the sum of their individual effects. Alternatively, we can also hypothesize this relationship as a necessary condition effect (Dul, 2016) following other examinations of such effects in the buyer-supplier literature (Sousa and da Silveira, 2017; van der Valk et al., 2016).

H3. a. *The effect of a higher extent of supplier involvement on business service quality is positively moderated by the moment of supplier involvement, such that this effect is larger when the supplier is involved earlier.*
H3. b. *An earlier moment of supplier involvement is a necessary condition for a higher extent of supplier involvement.*

Methodology

Data collection

To test the hypotheses, data is currently being collected on both sides of the dyad in a cross-sectional study design. The unit of analysis is a single specific service, that has recently been contracted to an external provider and for which operations have started. In particular, the services in the sample are 'facility services' which support the primary activities of a firm by organizing and executing services on 'facilities', which include all tangible assets of a firm, including buildings, infrastructure, workplaces, and people. Examples include cleaning, maintenance, providing furniture, and gardening.

Our sampling frame consists of approximately 1,000 members of Facility Management Netherlands (FMN), an industry organization for facility services. This research was announced on the organizations' website and through a mailing to all the members. The study is co-sponsored by this organization, which presumably helps to achieve a good response rate. Membership is individual and members include both buyers and suppliers of facility services. We use both groups to collect data, but for the current paper we only use the sample of buyers (546 FMN members) and have not yet collected data from their specific counterparts (suppliers) for this service.

We contacted FMN members by phone and asked for their participation in the joint study. The questionnaire, described hereafter, focusses on one particular service and asks for the contact details of the relevant person in the particular supplier's organization. Email reminders, after one and two weeks, and telephone follow-up, after four-six weeks, were applied when needed (Dillman et al., 2014). A shorter telephone follow-up questionnaire will be conducted with the identified supplier. Therefore, the results in this working paper are based on data from a single informant.

For this sample, we contacted 546 individuals, from which 171 were not qualified to answer our questions, hence, our effective sample was 375 FMN members. Another 103 were not willing to participate and 174 could not be reached by telephone—the latter were invited by email to participate later. Finally, 98 members agreed to participate and 71 actually participated to some extent. Due to missing data, the current analysis relies on the full information available from 48 respondents, an effective full response rate of 12.8%.

Measurement

All constructs as identified in the conceptual model have previously been used in the literature and have gone through extensive validation procedures. To ensure that the constructs, items, and scales were also valid in this context, we pretested the questionnaire with the help of two academic experts and four practitioners. These outside experts filled in the questionnaire while simultaneously listing any difficulty they came across and any suggestions for improvement. This helped to resolve any ambiguity in the questions and the wording of some items. No structural changes were made to the constructs or items.

Dependent variable

As a measure of service quality, a previously developed and extensively tested scale by Gounaris (2005) was employed. This scale, INDSERV, is a second-order construct to measure service quality in business-to-business services. Gounaris (2005) shows that INDSERV has better and sufficient psychometric properties than the commonly used SERVQUAL scale, in particular, for measuring business rather than consumer service quality. SERVQUAL suffers from low discriminant validity (the first-order constructs are not very distinct) and methodological complexity (it measures both expectations and perceptions, which is hard to differentiate between for respondents) (Cronin and Taylor, 1992; Dyke et al., 1999; see also: Ladhari, 2008). In contrast, INDSERV has adequate discriminant validity, a

high level of predictive validity, excellent convergent validity and internal consistency (Gounaris, 2005; Ladhari, 2008). This scale was translated and slightly adapted for the context of this study, see Table 2.

Business Service Quality is conceptualized as a second-order formative construct consisting of four first order constructs: potential quality, hard (process) quality), soft (process) quality), and output quality. This way of modelling a multidimensional construct is uncommon in the literature, but, following Jarvis et al. (2003) it makes more sense to say that service quality is the combination of the first-order constructs. In contrast, positing the first-order constructs as reflective of business service quality implies that the latter cause the former and that when business service quality increases, the level of all four first-order constructs is supposed to increase (Diamantopoulos and Winklhofer, 2001; Jarvis et al., 2003). Gounaris originally proposed service quality as a reflective construct at both levels, but also writes: "The *combination* of all these four dimensions *constitutes* a customer's overall perception of the quality of service." (Gounaris, 2005, p. 430, *emphasis added*). To make this type of modelling possible in structural equation modelling, we use all indicators of quality as reflective items of business service quality for secondary loadings, while making business service quality a second-order formative construct of its subdimensions simultaneously. This is known as the repeated measures approach in partial least squares (Sanchez, 2013; Wetzels et al., 2009).

Independent variables

As a measure of the moment of supplier involvement, we use two items similar to previous research (Handfield et al., 1999; Laseter and Ramdas, 2002): in which phase of the process and how long before operational start the supplier was first involved. For the service context of this study, and in consultation with the involved practitioners, the 'phases' were adapted, see Table 2. As a measure of the extent of supplier involvement, we use a multi-item reflective scale previously used in Wynstra et al. (2012) and building on others (Hartley et al., 1997; Petersen et al., 2005). Again, small adjustments were made to the wording of some items, such as 'project' into '(sourcing) process'.

Other measures

We also included measures for several control variables. First, we included a measure of project length, as one could argue that better service quality can be achieved simply through better preparation, which is then likely to also be reflected in more supplier involvement. Secondly, we include a control for firm size, as it is often related to success. Third, we include a dummy variable to measure public/private firms. Fourth, we measure service innovativeness, building on Ali et al., (1995) but adapted for the context of services. Highly innovative services may require supplier involvement more and lead to better service quality compared to more incremental or marginal improvements. Finally, we include controls for prior buyer-supplier relationship and its length, as again, this may relate to both (service) quality and higher levels of supplier involvement (Parker et al., 2008). Due to space limitations, the exact operationalization and measurement items for these controls are omitted from the paper.

Table 2. Constructs, items, and scales.

CONSTRUCT	ITEMS/QUESTIONS	SCALE
Moment of Supplier Involvement (MSI)	1. In which phase of the project did you first involve the supplier? Choose one:	While generating new ideas and concepts; While developing the concept and testing it; Immediately before supplier selection; After the supplier was selected and contracted; Not at all.
	2. How much earlier than the start date of the contract did you first involve the supplier	<1 month; 1-3 months; 3-6 months; 6-12 months; >12 months; Not at all.
Extent of Supplier Involvement (ESI)	1. The supplier was in charge of a considerable number of design, development, and operational tasks in the process. 2. The supplier was responsible for proposing solutions for the design and development for the service. 3. The supplier put in significant labor/time into the process. 4. The supplier served as an extension of our sourcing team (i.e., purchasing, facility management).	A six point semantic difference scale was used for each item (disagree-agree)
Business Service Quality (BSQ) Sub-dimensions		Sum of dimension scores
Potential Quality (PQ)	1. Offers full service 2. Has required personnel 3. Has required facilities 4. Has requires management philosophy 5. Has a low personnel turn-over 6. Uses a network of partners/associates*	A seven point semantic difference scale for each item (completely disagree-completely agree)
Hard Process Quality (HQ)	1. Keeps time schedules 2. Honors financial agreements / stays in budgets 3. Meets deadlines 4. Looks at details 5. Understands our needs	idem
Soft Process Quality (SQ)	1. Accepted enthusiastically* 2. Listens to our problems 3. Open to suggestions/ideas 4. Pleasant personality 5. Argues if necessary 6. Looks after our interests	idem
Output Quality (OQ)	1. Reaches objectives 2. Has a notable effect 3. Contributes to our sales/image 4. Is creative in terms of its offering 5. Is consistent with our strategy	idem

Results

To estimate the conceptual model as posited in Figure 1, we conducted path analysis using Partial Least Squares in plspm (in R 3.4.3) (R Core Team, 2017; Sanchez, 2013). The inner weighting scheme was 'centroid', measurement items were not scaled, tolerance was set to 1e-6, maximum iterations set to 100, and bootstrapping with 10,000 bootstrap samples. The complete measurement and structural model is displayed in Appendix A.

Both moment of supplier involvement and extent of supplier involvement are constructs with reflective items (2 and 4, respectively). Each of the dimensions of business service quality is constructed using their reflective items. Note that based on low factor loadings (<0.3) and significant cross-construct loadings, one item was dropped from the potential quality (PQ6) and soft process quality (SQ1) each. Finally, to approximate our conceptual model as closely as possible in PLS, we construct business service quality with all 20 reflective items for the quality scales as secondary loadings, i.e., the repeated indicators approach (Sanchez, 2013; Wetzels et al., 2009).

Table 3. Measurement model (full details available from the author – see also Appendix A)

	# items	Cronbach's alpha	Dillon-Goldstein rho	1st Eigenvalue	2nd Eigenvalue	Average Variance Extracted
MSI	2	0.454	0.786	1.29	0.706	0.647
ESI	4	0.902	0.932	3.1	0.426	0.755
BSQ	20	0.962	0.966	11.84	1.773	0.592
PQ	5	0.909	0.934	3.71	0.613	0.742
HQ	5	0.912	0.934	3.70	0.424	0.740
SQ	5	0.895	0.925	3.57	0.723	0.714
OQ	5	0.882	0.915	3.43	0.692	0.684

We first examined the measurement model in detail to assess the reliability and validity of each of the scales—we follow recommended thresholds (Hair et al., 2014; Sanchez, 2013). Chronbach's Alpha and Dillon–Goldstein's Rho's are well above 0.7 for most variables, indicative of high composite reliability. For moment of supplier involvement, Chronbach's alpha is a bit lower, because only two items were used; Dillon-Goldstein's Rho is a more appropriate measure for reliability with fewer items. The scales also exhibit unidimensionality, with first eigenvalues above 1 and second eigenvalues below 1. All scales have discriminant validity, with Average Variance Extracted always larger than the interconstruct correlations (see Table 4), except between the formative dimensions of BSQ. The scales show convergent validity with AVE's always above .5.

Table 4. Correlation matrix.

	MSI	ESI	PQ	HQ	SQ	OQ	BSQ
MSI	1						
ESI	0.246	1					
PQ	0.410	0.300	1				
HQ	0.346	0.268	0.754	1			
SQ	0.348	0.195	0.717	0.838	1		
OQ	0.225	0.366	0.660	0.848	0.783	1	
BSQ	0.373	0.313	0.865	0.949	0.918	0.901	1

Based on the feasibility of the measurement model, we then proceeded to examine the structural model. In particular, we related the two dimensions of involvement to business service quality, which itself is related to its four subdimensions, again, see Appendix A. The structural model has a very high goodness-of-fit of 0.81, to be interpreted roughly as the predictive power of the model. Path estimates provide further support for the predictive capabilities of our model.

Table 5. Structural model estimates.

Path	Estimate	SE	Hypothesis	
MSI→BSQ	0.006	0.005	H1 (+)	Supported
ESI→BSQ	0.004	0.004	H2 (+)	Supported
PQ→BSQ	*0.275*	0.022		
HQ→BSQ	*0.292*	0.018		
SQ→BSQ	*0.273*	0.020		
OQ→BSQ	*0.258*	0.030		

Notes. Significant estimates ($p<0.05$) are in italics. Based on 10,000 bootstrap replications.

The interconstruct correlation (Table 4) and the direction of the effect in the structural model (Table 5) provide support for Hypothesis 1, meaning that an earlier moment of supplier involvement is positively related to business service quality. Similarly, support is found in the data for Hypothesis 2, which means that a higher extent of supplier involvement is positively related to business service quality. Both hypotheses are also supported for the various sub-dimensions of quality, although not always at statistically significant levels.

Next, we examine the interrelationship between the two dimensions of supplier involvement and find a significant correlation. That is, a supplier with a higher extent of supplier involvement also tends to be involved in relatively earlier phases of the sourcing process. This provides initial support for Hypothesis 3a, while further testing of the interaction effect (as posited) cannot be implemented due to time constraints and modeling difficulties.

Based on the available literature, we also posited that the moment of supplier involvement is a necessary condition for the extent of supplier involvement, see H3b, such that a higher extent of involvement is only possible when the supplier is also involved in earlier phases. This approach requires additional testing using necessary condition analysis rather than regression-based techniques (Dul, 2016; Dul et al., 2010). Figure 2 presents a scatterplot of the two dimensions of involvement. This Figure shows that the two dimensions are not only related, but that the highest extent of involvement is not possible with very late involvement (lowest scores). Indeed, the necessary condition effect (Ceiling Envelopment-Free Disposal Hull) is 0.129, which is considered a small necessary condition effect, in support of Hypothesis 3b. However, as the plot shows, extent of involvement is only limited by involvement in the latest phase, in any earlier phase, all extent of involvement is possible.

For the sake of comparison, we also examined whether early and/or extensive involvement are necessary for higher levels of business service quality. In other words, we tested the equivalent necessary condition effects for Hypotheses 1 and 2. Our results show that both dimensions of supplier involvement in the sourcing process are necessary for business service quality, with effect sizes of 0.218 and 0.116, respectively. The highest levels of business service quality only occur with earlier than average involvement and with a higher extent of involvement than average. Plots omitted due to space considerations.

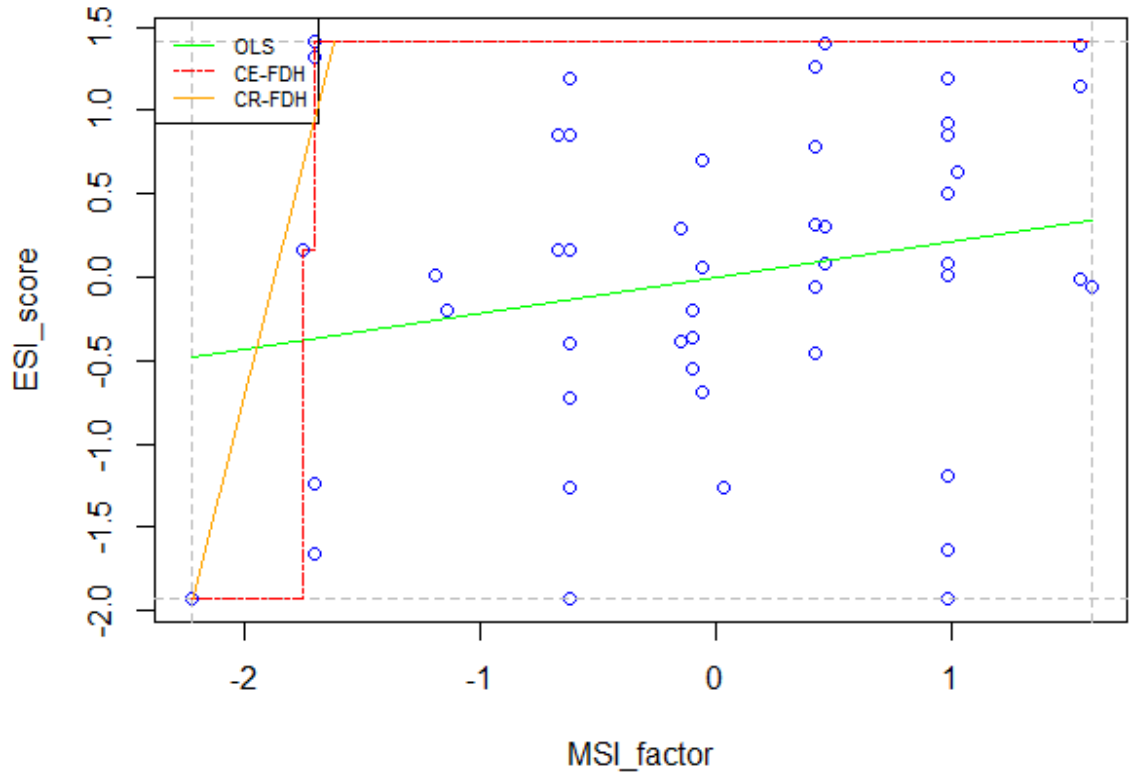

Figure 2. A scatter plot of the moment (MSI, x-axis; early is higher) and the extent (ESI, y-axis) of supplier involvement.

Discussion

In this paper, we have empirically examined the link between early and extensive supplier involvement in the sourcing process for business services and the resulting service quality. We have developed a more robust understanding of the role that suppliers play during the process of developing service specifications. Some of the literature suggests that suppliers should play an extended role in order to properly or clearly specify the desired services (Ellram and Tate, 2015; Tate and Ellram, 2012; van der Valk and Rozemeijer, 2009). Service specifications are developed over the course of the process (Selviaridis et al., 2011) and buyers often lack relevant service capabilities (Flowers, 2007; Selviaridis et al., 2013). Furthermore, since the quality of business services can only be determined after production, operation, and delivery (Gounaris, 2005; Grönroos, 2000), the business customer's satisfaction depends critically on the proper and clear specification of business needs and purchasing requirements up front. Hence, while buyers are typically not in the best position to develop such specifications properly (Selviaridis et al., 2013, 2011), the success of the service depends critically on the proper specification of the purchasing needs (Tate and Ellram, 2012; van der Valk and Rozemeijer, 2009). In conclusion, the sourcing process of business services requires buyers to leverage their suppliers' knowledge and capabilities (Flowers, 2007; Grant and Baden-Fuller, 2004; Wynstra et al., 2017).

To date, very few empirical studies have examined this process of co-developing service specifications in detail and this study provides a first attempt at clarifying the effects of involving suppliers in the sourcing process for business services. In this paper, we report research as part of a larger ongoing research program into buyer supplier collaborations in the sourcing process, and in particular, into the co-development of service specifications. We collected data from buyers of facility services on the moment and the extent of their

suppliers' involvement in the sourcing process and their satisfaction—measured by business service quality—during service operations.

We find, firstly, that involvement of suppliers in earlier phases of the sourcing process has a positive impact on the buyer's satisfaction with the service. By involving suppliers early, buyers leverage their suppliers' knowledge and expertise with similar types of services, which, due to increased outsourcing of these services, they lack themselves. Hence, earlier involvement of suppliers is an efficient methodology for knowledge integration and application (Grant and Baden-Fuller, 2004). In fact, preliminary analyses also support that earlier involvement of supplier is a necessary condition for higher levels of quality.

Secondly, we find that more extensive involvement of suppliers in the sourcing process also has a positive impact on business service quality. By involving suppliers extensively, buyers can leverage their suppliers' service capabilities in the development, implementation, and operation of business services (Flowers, 2007). Hence, more extensive involvement of suppliers in the sourcing process allows buyers to leverage a 'connecting capacity' or 'indirect capability' for using their suppliers resources and practices to their advantage (Lichtenthaler and Lichtenthaler, 2009; Loasby, 1998). Our findings show that involving suppliers more extensively is a necessary condition for achieving high levels of quality.

Thirdly, we find that the two dimensions of involvement are related (Bidault et al., 1998; Monczka et al., 2000) and that an earlier moment of supplier involvement is necessary for a higher extent of supplier involvement. In particular, we find that suppliers with the highest extent of involvement are also involved in relatively earlier stages of the sourcing process.

Limitations and Future Research

In this paper, we present the first findings on the effects of supplier involvement in sourcing business services, as part of a larger research program into this phenomenon. Therefore, a number of limitations of the current study are addressed as part of the larger program. In particular, the data presented in this paper stems from a single respondent on one side of the dyad (buyer) and endogeneity and common method bias may therefore become a threat to the validity of the findings (Craighead et al., 2011; Ketchen et al., 2017; Roberts and Whited, 2013). In the larger program, we are also collecting data from the buyer's supplier counterpart for the specific service, which will allow us to use data from multiple sources and from both sides of the dyad. Furthermore, the sample size is relatively low, which perhaps explains why some of the relationships are not statistically significant. Another limitations of this study is the relatively limited amount of questions that could be asked—in order to ensure response. Therefore, the conceptual model is straightforward and contains just three main concepts. Other research is needed to address issues such as supplier selection for involvement (Schiele, 2006) and continuous contract management (Nullmeier et al., 2016).

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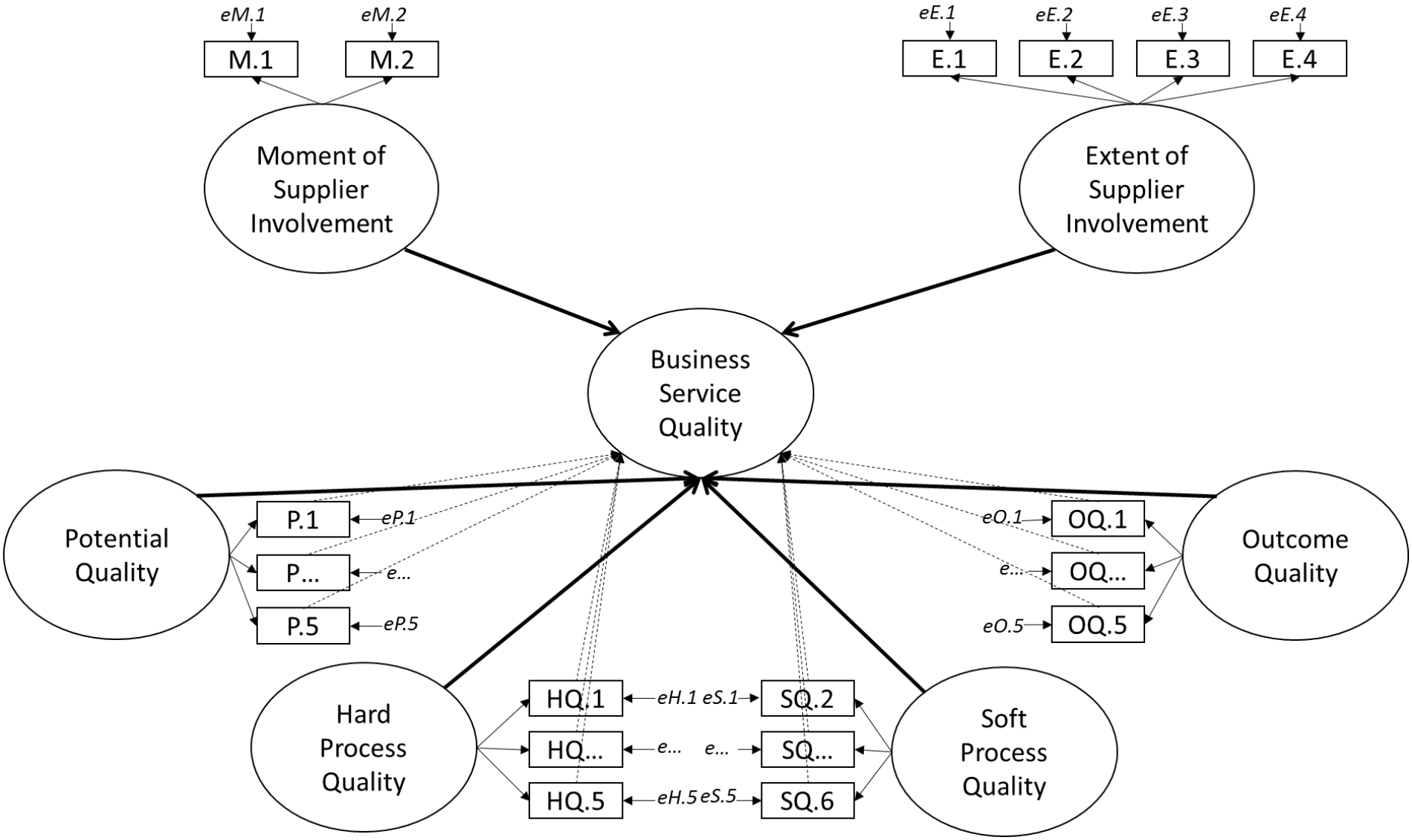
Appendix A: Measurement and Structural Model



Procurement Business Partnering: Adding Value through Innovation

Georgios Tamiolakis
Medical Category Manager, Region AMEA, Novartis Hellas SACI, 12th km National Road #1, Metamorfosis, Attica 14451, Greece. Email: georgios.tamiolakis@novartis.com

Lambros Laios
Professor Emeritus University of Piraeus, 11 Seferi str, Nea Kifissia, Attica 14564, Greece. Email: llaios@unipi.gr

Abstract

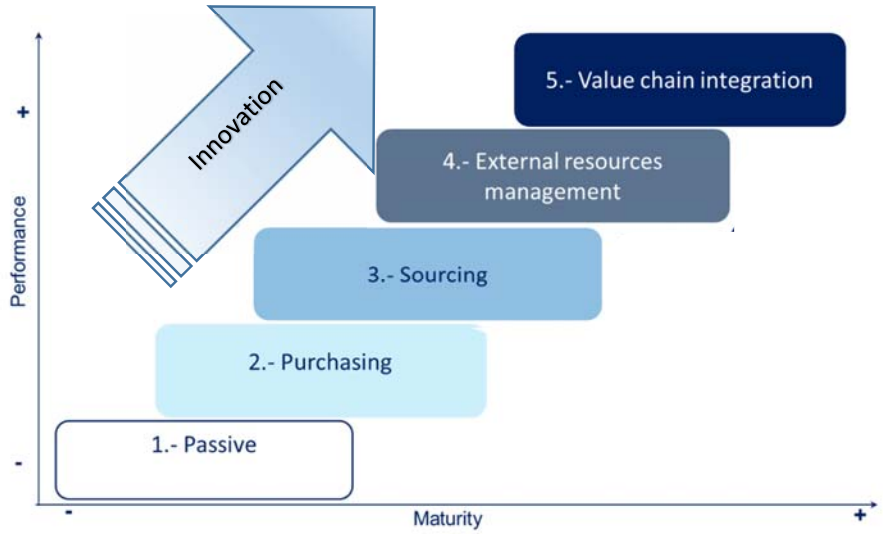
Procurement departments worldwide strive to become more relevant to the business, actively demonstrating the added value they can deliver by expanding their scope and activity beyond the boundaries that outlined Procurement's role so far. The authors consider that procurement can position itself as a **key business enabler**, maximizing the return on investment not only by securing fit-for-purpose services at a reasonable value**,** but also by offering competitive advantage to the business through **supplier-enabled innovation.** Two different case studies are presented herewith, demonstrating how procurement can go beyond traditions and deliver value in ways that were formerly unexpected.

Keywords: Procurement Added-Value; Supplier-Enabled Innovation; Crowdsourcing

Procurement evolution path

As organizations grow more sophisticated in the way they purchase goods and services, they adjust the procurement function accordingly. From simple **purchasing** all the way to **Value Chain Integration,** procurement maturity is linked to the level of dependency of the organization on its suppliers.

In more advanced phases, procurement is expected to **enable competitive advantage** for organizations through **access to innovation**. The ability to **spot, attract** and **integrate** innovation quickly and effectively, becomes a matter of vital importance. This is particularly true in industries such as FMCG, automotive sector, electronics, etc. where innovation is quite often coming from the networks of suppliers.



Spotting, Attracting, and Integrating Innovation

Socrates, the famous ancient Greek philosopher, once stated that "*True knowledge exists in knowing that you know nothing"*. Indeed, the more we learn and grow through professional experience, self-improvement, etc. the more conscious we become of the countless options that exist out there, most of which we will never discover that they ever existed. Inevitably, professionals tend to resort to **accessible sources**, when elaborating on a certain problem. This would range from their narrow professional surrounding to a few trusted suppliers or maybe certain academic sources when applicable.

Graphical representation of the range of possible options to problem-solving.

Technological advancements, however, have unlocked other options as well, as people from around the world can now connect through virtual platforms or social media. This enables access to an unprecedented width and variety of resources that could contribute to resolving a problem – what is referred to as **Crowdsourcing**.

We present two case studies which demonstrate the differing paths of accessing innovation.

Case Study 1: Attracting Market Innovation - Supplier Innovation Workshop

The basis for success in this approach is the close collaboration with selected suppliers, which is further enhanced by formally integrating innovation discussions into it. While a Procurement department can hardly *generate* innovation, they are well positioned to *scout* for it; indeed, suppliers may offer solutions to problems *known* or sometimes *unknown* to the organization. All suppliers are seeking business development opportunities, which they can achieve either by **selling more** of the same products / services, or **selling diverse** products / services. Our interest, for the scope of this paper, lies with suppliers pursuing the latter.

Human beings, by nature, are inclined to pursue **meaningful**, but also **achievable** goals. Therefore, a company that becomes established in the market as a customer that **welcomes innovation**, is likely to attract suppliers able to offer it.

The market could be alerted of such a positioning through an "innovation event", addressed to key suppliers. The event may involve suppliers across industries, if the scope of the day is simply to broadcast certain messages to the market, and have generic discussions on innovation (followed at a later stage by more specific meetings / workshops). Alternatively, if the intention is to condense more work in the same day, sector-specific innovation events would be advisable, including plenary sessions followed by actual workshops. In this case, the suppliers should come well prepared beforehand.

Event Prerequisites:

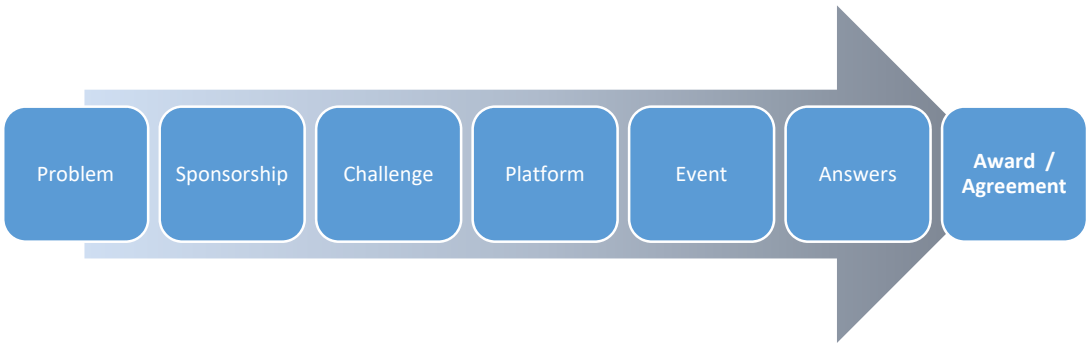
Ensure team Commitment	The procurement team needs to commit upfront to this initiative, in order to devote adequate time for aligning with suppliers, internal customers, following up on progress, etc.
Internal Stakeholders' alignment & engagement	Start with internal mapping to identify open-minded stakeholders with a drive to test new things in the given period. Invite key internal stakeholders to present to the suppliers and convey their messages, showing their commitment to collaborate.
Suppliers' Selection	It is advisable to develop clear invitee selection criteria, certainly including suppliers with demonstrated capability to bring novelty to the table. This also serves to address queries from non-invited suppliers.
Hospitality	Hospitality to invitees is important, clearly setting an "inviting tone" to strengthen the partnership and adopt new approaches. This includes mindfulness of any confidential info they might want to share, possibly calling for separate / supplier-specific sessions.
Detailed Agenda	Agenda to be distributed upfront, with a clear logic and references to covered topics. It is important to allow enough time for breaks and socializing, which will enable vivid discussions among invitees (internal and external), perhaps even triggering the first opportunities.
Clear Messaging	All attendees should leave with a clear and common understanding (key takeaways) and buy-in to return with their value-added proposals.
Follow up	It is vital to close the loop by inviting all suppliers to submit their ideas, which should then be evaluated and short-listed together with the business. All suppliers should receive feedback on their ideas.

Materialization	For this initiative to gain credibility, tangible results need to emerge in the end. This will call for additional meetings, possibly workshops, and engagement from procurement and relevant internal stakeholders
Communication	Success stories should be communicated internally and externally afterwards. Other suppliers should also be informed to keep our company as "top of mind" client when novelty comes to the table.

Novartis Hellas hosted such an event in the past, with participation of **50 suppliers** across **11 sectors.** Within three months, the event produced **28 ideas,** of which **11 eventually materialized**, with positive impact in diverse business areas (ranging from document management, car fleet and telecoms to virtual congresses and patient support programs).

Case Study 2: Bringing the Outside in - Innovation through Crowdsourcing

Crowdsourcing can simply be explained as a business challenge posted to a specific internet platform, where it can be accessed by various groups of professionals, academics, etc. (usually referred to as "solvers") trying to offer solutions, in return for a monetary return to the winner. The success of this approach lies on the wide variety of new suppliers, and the diversity of possible solutions that all this collection of mental power can bring. The sequence of actions to conduct a Crowdsourcing event could be outlined as follows:



Problem: Identify, in collaboration with the business, a **clear problem to solve**. It is important to stress that Procurement is merely offering a service provision that *may* lead to a solution. This helps the business overcome the initial reluctance or surprise. Close collaboration with the business and deep understanding of their needs and priorities is of course essential.

Sponsorship: After the problem has been defined, a sponsor to support this approach is needed. It would be advisable to assign a steering committee and a project team, involving all relevant parties. In addition, Legal and Finance need to be advised upfront for any potential implications, as Crowdsourcing sets new sourcing patterns for the company,

Challenge: The formation of the actual challenge to be posted for the potential solvers, will take some time to digest and be able to properly reproduce in the future. Among others, one will need to define: the **type of event** to set up (to specific experts vs. totally open); the **type of challenge** (public or anonymous); any **constraints** relevant to confidentiality / intellectual property aspects (ensure that no confidential info is shared, also ensuring that solvers' submissions become intellectual property of the company); the **award** for the winner(s); the **supplier selection criteria**

Platform: Several platforms are already available in the internet, and all of them follow more or less the same logic, perhaps with some differentiation in the provided services, fields of specialization and costs. What is really important is to see their **crowd** and how they manage it. In some cases we might have to recruit and register participants to our Crowdsourcing event.

Event: Apart from posting the challenge, we also need to let potential solvers know of the award for the winner(s). As expected, the further we expand our reach to external resources, the more irrelevant solutions are likely to flow in. This happens because the remoteness of potential solvers from the topic could generate misinterpretations. Therefore, a key success factor is to describe the problem as **clearly and accurately** as possible, incorporating any relevant side-information, while also maintaining an open line to handle solvers' queries.

Answers: Once the event is closed, we need to review and prioritize the answers. Defining clear and correct selection criteria is important, but not always easy. The submitted answers need to be reviewed in collaboration with the business, to short-list solvers for final review and eventual selection.

Award: Having completed all above steps, we are now ready to award and close positively the event. We could qualify more than one proposals if it makes sense.

Three examples of such projects at Novartis are outlined below:

1st example: Crowdsourcing was selected instead of the traditional bidding process for the production of a video for a contact lens ad. Instead of the usual creative agencies, the request was addressed to 67,000 solvers with great capabilities, ideas, and extreme motivation to compete. The process lasted less than 3 months and 2 great videos were selected and awarded, with 96% savings! (Winners' award vs. normal creative agency fees for this work)

2nd example: This concerns the development of a patient mobile app, which would normally include a standard RFQ with suppliers, a process that usually takes several months to agree on the specifications, negotiate prices, have the contract signed, develop and test the app, etc. Crowdsourcing returned **33** already developed apps, more or less working under test environment. Those were short listed down to 10, the final winner being a silicon-valley start-up who quickly provided a great product, with more than 50% savings (award vs normal price for a similar piece of work). Moreover, Novartis got introduced to many suppliers and acquired a much better view of the potential supply base, while the suppliers learnt a lot on customer needs while developing the app for submission, which helped them improve their proposals going forward.

3rd example: A production plant had problems in weighing small quantities of powder for a production line. The engineering departments had been looking for solutions for some time without success, so they agreed to make a crowdsourcing event for this. A few months later, 30 potential solutions were received, 9 of which were awarded! The best proposal came from a Chinese scientist working on a completely different subject, but with a similar problem, which led him to develop his home-made weighing system! The initial problem was now simplified to the industrialization of an existing small-scale solution.

Additional Considerations

Crowdsourcing, by design, brings our organization in contact and possible collaboration with totally unknown suppliers. For this reason, it is advisable to involve Legal department from the very beginning, to ensure that any legal considerations, including –but not limited to-

confidentiality of what we share publicly, Intellectual Property rights, lack of ink-signed contractual engagement, etc. are adequately and timely addressed.

Conclusion

Innovation is highly valued by the business, as it is linked with competitive advantage, but it is not an easy goal to achieve. This paper presented different approaches that procurement departments can employ to **spot**, **attract** and **integrate** innovation. None of these approaches is a panacea careful evaluation of the method selected each time is needed. What is certain, procurement can only achieve sustainable results in this area by staying close to the business, ensuring that internal customers come proactively with their issues, allowing time for new approaches. Last, but not least, success stories always need to be broadcasted, to keep attracting interest on innovation.

Acknowledgements

Much of the information captured here is based on the work of **Robert Zimmer**, Novartis Global Category Manager, Digital Services, who has been really active in the field of supplier-enabled innovation for many years now, with exceptional results. Lots of credit also goes to **Stephane Morel**, Novartis Global Head of Procurement Capabilities Development, whose support, guidance and provision of valuable insights were decisive in putting together this piece of work.

Seeing the Forest and Not the Trees: Learning from Nature's Circular Economy

Wendy L. Tate.[a], Lydia Bals [b, c, *], Kai Foerstl [d], Cristof Bals [e]

[a] *Associate Professor of Supply Chain Management, University of Tennessee, 315 Stokely Management Center, Knoxville, TN 37996-0530, phone: 865-974-1648 , United States, Wendy.Tate@utk.edu*

[b] *Professor of Supply Chain & Operations Management, University of Applied Sciences Mainz, Lucy-Hillebrand-Str. 2, 55128 Mainz, phone: 0049(0)6131-628-3293, Germany, lydia.bals@hs-mainz.de*

[c] *Visiting Professor at Department of Strategic Management and Globalization (SMG), Copenhagen Business School(CBS), Kilevej 14, 2. Floor,2000 Frederiksberg, Denmark; lb.smg@cbs.dk*

[d] *Chair of Supply Chain Management, German Graduate School of Management & Law (GGS), Bildungscampus 2, 74076 Heilbronn, Germany, Kai.Foerstl@ggs.de*

[e] *Doctoral Student, Technical University Dortmund, Leonhard-Euler-Str. 5 D-44227 Dortmund, Germany, cristof.bals@tu-dortmund.de*

* *Corresponding author*

"The ideas which are here expressed so laboriously are extremely simple and should be obvious. The difficulty lies, not in the new ideas, but in escaping from the old ones, which ramify, for those brought up as most of us have been, into every corner of our minds" J.M. Keynes, 1973, preface

Summary

There are many examples from nature and natural systems that can provide inspiration (referred to as biomimicry) for the structural aspects of complex business systems using, reusing, and repurposing materials and components in a way that is sustainable. Biological networks provide inspiration regarding how business networks can communicate more quickly and effectively via information transmission to reuse materials/resources in continuous cycles. An in-depth case study was performed to support and further develop the idea of biomimicry in a business setting, showing that business can learn how to be more sustainable from the processes defined by natural networks.

Keywords

Circular economy; theory; supply; value; chain; network; system; biomimicry; biomimetic; mycorrhiza; cycle

Submission category: Working paper

Introduction

New ways of thinking about how to manage resources are required to address growing resource depletion and the rising threat of global climate change. This is reflected in the current movement of corporate sustainability, where both environmental and social issues are increasingly forcing more and more companies to assume a decisive stance in developing a sustainable and efficient economy for the future. To be effective in this future environment requires new perspectives and

innovative ideas to reconfigure current business practices in ways that help mitigate corporate and consumer impact on the planet.

The greatest challenge is to create an economy which aims to eliminate waste altogether as is the case in natural ecosystems. The natural environment is characterized by a continuous cycle of salvage and reuse, where waste from one process can move as input to another, completely unrelated process. The realization of this challenge has led to efforts to establish and promote a circular economy. The European Commission has defined this as an economy in which "…the value of products and materials is maintained for as long as possible; waste and resource use are minimized, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value" (EC, 2015, p. 1).

The goal of operating in a circular environment stands in stark contrast to current business reality. For instance, waste from electric and electronic devices (e-waste) is on the increase. Baldé, Forti, Gray, Kuehr, & Stegmann (2017, 4ff) state that: "All the countries in the world combined generated a staggering 44.7 million metric tonnes (Mt), or an equivalent of 6.1 kilogram per inhabitant (kg/inh), of e-waste annually in 2016 […]. Globally, only 8.9 Mt of e-waste are documented to be collected and recycled, which corresponds to 20% of all the e-waste generated. The total value of all raw materials present in e-waste is estimated at approximately 55 Billion Euros in 2016 […]. Circular economy models need to be adopted to encourage closing the loop of materials through better design of components, recycling, reusing, etc., while mitigating the environmental pollution. Therefore, the circular economy concept offers huge economic and employment opportunities for e-waste management; the presented 55 Billion Euros of secondary materials is an underestimate of those economic opportunities."

In line with circular economy aspirations, the need to consider both closed and open material loops in both technical and biological cycles has recently been emphasized (De Angelis, Howard & Miemczyk, 2017). Rapid industrialization and urbanization in some developing economies has increased the need for effective and efficient use of resources (Guan & Chen, 2012). When realized, the circular economy, using principles learned from nature, would transform the function of resource utilization. Waste from factories would become valuable inputs to other processes and even across industries as products are repaired, reused or upgraded or individual materials are repurposed instead of being thrown away (Preston, 2012). Understanding the shift of perspective from a closed, mechanistic business ecosystem, to a circular value system is the overarching premise of this paper.

Companies are starting to realize the importance of looking toward natural systems and trying to emulate the more organic or fluid ecosystems (Winn & Pogutz, 2013). The lens they are looking through is referred to as biomimicry or biomimetics, a method imitating techniques and processes of nature to achieve effectiveness, efficiency and sustainability (Benyus, 1997). Biomimicry has been seen in new product development research and practice, such as, self-cleaning façade paints based on the water and dust-repellent properties of the lotus leaf (Sivakumar, Balasubramanya, & Sundaresan, 2012). However, biomimicry reaches beyond products and includes management and organizational insights from nature: "Biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies. The goal is to create products, processes, and policies—new ways of living—that are well-adapted to life on earth over the long haul" (Biomimicry Institute, 2017). The benefit of using biomimetic principles is that they are proven over 3.8 billion years, as this earth thrives and is governed by balance (Kennedy, 2013).

For the purpose of this research, advancing understanding of the preconditions for a circular economy, the biomimetic focus is placed on networks of fungi that support forest ecosystems by

distributing nutrients and information, an area which has been studied in biology for decades (Simard, Beiler, Bingham, Deslippe, Philip, & Teste, 2012). Within these ecosystems, the fungi networks play a central role in carbon, water and nutrient cycling and redistribution of resources (Warren, Brooks, Meinzer, & Eberhart, 2008; Allen, 2007; Treseder, 2004; Eason, Newman & Chuba, 1991), which is needed to keep the system circular. A comparable mechanism is missing in the current business ecosystem.

The overarching purpose of this research is to integrate the concepts of systems thinking with biomimicry for business ecosystem design. The business ecosystem should waste nothing through closed and open-loop reuse and redistribution of productive resources. The specific research question in focus here is: *"How can biomimetic principles be utilized to transition from the current mechanistic business ecosystem to a circular value system?"* To answer this question, a review of literature on the processes and operations of the fungi network in forests was first performed. The concepts discovered from this assessment allowed for the design of an in-depth case study which was conducted with an innovative organization that recognizes the importance of circular systems and works to facilitate an interconnected system that reuses and redistributes productive resources.

This paper is organized as follows. The primary tenets from biomimicry and the fungi network are assessed first, followed by complex adaptive systems and network theory. Next, the research methods are described. Based on reflection and elaboration of case study findings in relation to the biomimetic setting of fungi networks, five biomimetic principles are developed that lead the way to future research avenues. Before concluding the paper, contributions to management theory, practice and education as well as future research suggestions are discussed.

Focusing on Biomimicry

The resilience of an organization is interdependent on the resilience of its business ecosystem. The more centralized and hierarchical information flows (and subsequent material flows) become, the more vulnerable they are to disruption. In contrast, nature constructs webs or systems in which there are built-in redundancies and countermeasures. As Kharrazi, Kraines, Rovenskaya, Avtar, Iwata and Yarime (2015, 806) summarize: "High levels of efficiency tend to weaken the system's ability to respond to shocks or disruptions to its internal flows, whereas high levels of redundancy are costly to maintain and thereby tend to weaken the system's internal development and its ability to distribute flows in an orderly way. Therefore, from the perspective of the ecological information-based approach, sustainability is achieved when the system maintains robust delivery (i.e., the intensive dimension) while also achieving a reduction in the total usage of resource (i.e., the extensive dimension)."

Both dimensions aim at eliminating the trade-off between redundancies and increasing resilience. In line with circular economy aspirations, the need to consider both closed and open material loops in both technical and biological cycles has recently been emphasized (De Angelis, Howard and Miemczyk, 2017). Rapid industrialization and urbanization in some developing economies has increased the need for effective and efficient use of resources (Guan and Chen, 2012). The circular economy, using principles learned through biomimicry, would transform the function of resource utilization. Waste from factories would become valuable inputs to other processes and even across industries as products are repaired, reused or upgraded or individual materials are repurposed instead of being thrown away (Preston, 2012). This type of thinking aligns with the processes that occur in nature. Some companies are starting to realize the importance of looking toward natural systems and trying to emulate the more organic or fluid ecosystems (Winn and Pogutz, 2013). This lens is referred to as biomimicry or biomimetics, a method imitating techniques and processes of nature

to achieve effectiveness, efficiency and sustainability (Benyus, 1997). Biomimicry has been seen primarily in new product development research and practice, such as, self-cleaning façade paints based on the water- and dust-repellent properties of the lotus leaf (Sivakumar, Balasubramanya and Sundaresan, 2012). But biomimicry reaches beyond products and includes management and organizational insights from nature: "Biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies. The goal is to create products, processes, and policies—new ways of living—that are well-adapted to life on earth over the long haul" (Biomimicry Institute, 2017). The potential benefit of using biomimetic and natures principles is that they are abundant and proven over 3.8 billion years, as this earth thrives and is governed by balance (Kennedy, 2013).

For the purpose of this research, the biomimetic focus is placed on networks of fungi that support forest ecosystems by distributing nutrients and information, an area which has been studied in biology for decades (Simard, Beiler, Bingham, Deslippe, Philip and Teste, 2012). Within these ecosystems, the fungi networks play a central role in carbon, water and nutrient cycling (Warren, Brooks., Meinzer and Eberhart, 2008; Allen, 2007; Treseder, 2004; Simard, Perry, Jones, Myrold, Durall and Molina, 1997; Eason, Newman and Chuba, 1991).

Methodology

The goal of this paper is to elaborate on theory that integrates the concepts of systems thinking with biomimicry for business system design. The business system should waste nothing through closed- and open-loop reuse and redistribution of productive resources while being resilient in the face of disruptions. The specific research question in focus here is: *"How can biomimetic principles be utilized to transition from the current mechanistic business ecosystem to a circular value system?"* To answer this question, extensive review on the processes and operations of the fungi network was performed. The concepts discovered from this assessment allowed for the design of an in-depth case study which was conducted with an innovative organization that recognizes the importance of circular systems and works to facilitate an interconnected system that reuses and redistributes productive resources.

Preliminary findings and outlook

The five biomimetic principles derived from the analysis are shown in Table 1.

Main Ecosystem Variables	**Corresponding Biomimetic Principle**	**Theoretical Implications**
Roles of Agents/Actors	**Principle 1:** The ecosystem has enough scavengers and decomposers	Move beyond analyzing ecosystem producers and consumers, deliberately including the two roles of scavengers and decomposers.
Structural Characteristics (Decentralized vs. Centralized) (Interdependent vs. Independent)	**Principle 2:** The ecosystem has reliable, decentralized information storage **Principle 3:** The ecosystem has products designed for reverse material flows	Move beyond the focus of linear flows of either materials and/or information and/or financial flows, to a simultaneous perspective. Also, deliberately include reverse flows for materials.

		Challenge assumptions of centrality by reflecting on latest technological developments in terms of decentralized information storage and processing.
Co-Evolution (of Actors and the System)	**Principle 4:** The ecosystem members collaborate, joining varied capabilities toward co-evolution	Study ecosystem members with a synergistic lens, looking beyond "traditional" large firm actors, to deliberately include start-ups, intrinsically motivated individuals or NGOs, and how they co-evolve.
Internal Mechanisms (Emerging and self-organizing vs. hierarchically governed); (Reciprocity and circularity vs. Causal and deterministic); (Openness vs. separation); (Connective vs. encapsulated)	**Principle 5:** The ecosystem members see the forest and not the trees, acting in line with the other principles	Move beyond basic assumptions of short-term focus and narrow economic objectives of actors. Move beyond hierarchical governance to how ecosystem members collaborate self-organized toward a common, emergent goal (e.g. circular economy).

Table 1 – The biomimetic principles' main relation to specific ecosystem variables from literature and their summary of theoretical implications for network and complex adaptive systems research

As a broad outlook, in a way, the coordination in fungal networks in forest systems is still incredibly superior to human systems, even if we emulate the ubiquitous information and reverse material flows. One of the reasons is that the resource-sink coordination in our economic system is done primarily by price/willingness to pay. Whether that transfer is actually (most) beneficial to the overall system is not taken into account, which is actually factored in the natural ecosystem. If 10 tons of secondary material steel are going on the secondary market and a producer of luxury barbecue grills has the highest willingness to pay, that is where the material goes, even if there is an orphanage bidding for it that wants to build a new roof. That would not happen in nature. Nevertheless, improving resource efficiency and eliminating waste in mimicking fungal networks will already take us a long way compared to the current, wasteful economic system we operate.

The case study research in this paper relies mostly on interviews and materials related to two organizations. For future research, widening the scope of companies and also following a longitudinal approach holds further potential. Nevertheless, the innovative company studied provided a unique opportunity to study an early emergence of a fungi-like network element toward a circular economy.

For future research, such insights from biomimicry might also have explanatory power for the rise of the gig economy and sharing economy phenomena, currently visible. An example from nature related to resource allocation and sharing is illustrated by hermit crabs. They form a line of different-size shell searchers when one crab has found a shell too large for itself and then engage in the following process: "Synchronous vacancy chains occur after several crabs adjacent to an available vacant shell have queued in decreasing size order; as soon as the largest crab switches

into the vacant shell, a rapid series of sequential shell switches takes place" (Rotjan, Chabot & Lewis, 2010: 639).

In addition, the idea of ''meta-networks'' from research on forests also provides another interesting avenue for future research. Such meta-networks are a series of hierarchical, interacting networks and have been found to play an important role in forest resilience, when disturbance thresholds are crossed (Simard, 2009). "The interactions among these three networks: mycorrhizal, plant community, and nest networks; reinforce each other. […] I propose that these three networks function as a hierarchical ''meta-network'', where (a) each network is classified as a network guild according to the manner in which it acquires limiting resources (i.e., fixed carbon for ECM fungi, soil water and nutrients for establishing trees, and canopies and cavities for small mammals) (after Martin & Eadie, 1999), and (b) the networks interact with and stabilize each other, from which emerges complex structures and functions that stabilize the whole forest" (Simard, 2009: 103).

Another aspect for further consideration is that fungi networks combine information and material flows within one ubiquitous network. Or, as it has been said: "Perhaps the single most compelling attribute of MNs [mycorrhiza networks] is their potential to act as below ground avenues for the transfer of C [carbon] and nutrients among plants within a community" (Simard et al., 2012: 43). The area of "physical internet" could, therefore, strongly benefit from a biomimetic perspective that combines the information and physical material flows in an internet-like hub and spoke system (Sternberg & Norrman, 2017). The fungi networks, as a result of natures tried and tested evolution, might also be of avail to design those.

This research concurs with the conclusion by Murray, Skene & Haynes (2017: 377), who state: "A sustainable future for the human race will demand systems-based thinking that involves, in equal measure, society, environment and economics. It is the re-knitting together of these pillars of sustainability that must happen if we are to rediscover a balanced existence with the rest of the biosphere. […] A circular economy involves entire networks of production, and there is a diffusion of responsibility throughout these networks, with the producer and consumer not remaining ethically neutral. Future research should begin to incorporate the latest ecological knowledge into our understanding of naturalistic economical models and systems, without silencing the social and human dimension." The biomimetic principles presented in this research will hopefully serve as stepping stones to facilitate the shifts in perspective necessary to develop circular value systems.

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Purchasing department's internal legitimacy: A long and winding road

André Tchokogué
HEC Montréal, Canada
Email: Andre.Tchokogue@hec.ca

Jean Nollet
HEC Montréal, Canada
Email: Jean.Nollet@hec.ca

Gilles Paché
CRET-LOG, Aix-Marseille Université, France
Email: gilles.pache@univ-amu.fr

Raluca-Mihaela Stoleru
Bombardier Aéronautique, Canada
Email: Raluca-Mihaela.Stoleru@aero-bombardier.com

Abstract

This paper addresses the issue of how a purchasing department develops legitimacy within an organization. Legitimacy corresponds to the actions of an entity – in this case the purchasing department – which are desirable, proper, and appropriate. Based on an extensive literature review, the main characteristics of a purchasing department's internal legitimization strategies (pragmatic, moral and cognitive legitimacy) and of the factors influencing their implementation are identified. The objective of this paper is to discuss how a purchasing department's internal legitimacy could be a crucial driver of purchasing practices and to suggest how the concept of legitimacy contributes to PSM theory.

Key words: Image, Legitimacy, Purchasing department, Reputation, Recognition

Topic: Purchasing organization, skills and competences

Category: Working Paper

Introduction

In an article focused on the "made in France" champions, Letessier (2013) discusses about the family-owned Clarins, a European luxury cosmetics leader. Since it could count on French suppliers of high-quality components, Clarins' top management decided not to outsource to foreign suppliers. Therefore, it would be easy to conclude that it is the partnerships developed with its suppliers – or *inter*-organizational relationships – which contributed to its success. However, upon closer examination, the main success factor was rather the alignment of its purchasing, logistics and marketing strategies – and, therefore, the *intra*-organizational relationships (Hochrein et al., 2017). For instance, the logistical operations have been developed to satisfy the high-end positioning of the products, while the two-month inventories of key components in the plant located near Paris eliminate stockouts. Clearly, this is an excellent example of a well-integrated strategy, which emphasizes a high level of intra-organizational collaboration. However, such a context has to be created, with all departments involved moving in a common direction. After all, isn't it what a strategy is supposed to be about?

In practice and despite the abundance of management literature on the topic, a situation like Clarins' is not as typical as one would expect; conflicts between purchasing and the other departments are common. For instance, in the new product development (NPD) process, the purchasing department faces engineering's requirements leading into a sole supplier situation, while the purchasing manager might have developed an excellent relationship with a long-term supplier with the intent that the organization becomes a preferred customer (Schiele, 2012). With the marketing department, conflicts are more likely to arise in issues such as product customization: it then becomes customization vs. standardization, or said differently, seeing customization as a trade-off between making the customer loyal and savings through larger quantities; actually, mass customization creates a spare parts variety which might well be incompatible with the objectives associated to global purchasing (Ferguson et al., 2014). Finally, with the operations department, the purchasing department is often confronted to very different perceptions about the importance of costs, and this leads to opposite prioritizations, founded on non-congruent functional measures and goals (Pagell, 2004).

In fact, the existence of tense relationships between the supply department and the other departments have existed for a long time. From a supply department's perspective, the other departments' objectives often seem contradictory with its own with respect to low costs, high quality, and fast turnaround times. Consequently, it appears nearly impossible to meet all objectives concurrently; then, it is not surprising that the other departments might consider that the supply department's legitimacy is low. So the challenge becomes: how can a supply department improve its internal legitimacy, considering that a high level of internal legitimacy increases a supply department's power, as well within as outside the organization (Cousins et al., 2006)? In fact, a supply department's legitimacy will be considered "high" if it can align its results with the objectives set by top management so that the organization can be in a sustainable competitive position; for instance, if an organization pursues a cost leadership strategy, the supply department must absolutely prioritize cost reductions over quality improvement and innovation (Baier et al., 2008; Hochrein et al., 2017). However, how can legitimacy be developed?

Much research has been performed on legitimacy in the fields of sociology, political sciences and business administration (for instance, see Tilling, 2004; Bitektine, 2011; Rogowski, 2015). One of the interesting findings coming out of the research in those fields is that it is possible for managers to increase their department's legitimacy through appropriate legitimization strategies. This question touches upon seminal works in organizational theory sociology, such as Weber's (1922); according to this author, legitimacy comes under three categories: (1) "charismatic", which is based on a leader's personal authority or a person's heroic stance; (2) "traditional", which relies on an immemorial or uncontestable tradition; and (3) "legal",

which is established based on the adherence to impersonal and universal laws. By applying this reasoning to a purchasing department, we can equate it to (1) the charisma of the purchasing manager or vice-president in charge; (2) the purchasing department being perceived as a core competence; and (3) when it is acknowledged that due to the costs of all goods and services acquired, those numbers by themselves justify the department's legitimacy.

The concept of legitimacy has been discussed in the field of organizational theory (Deephouse and Suchman, 2008). However, research on this topic has been rather limited in the field of PSM. It is mostly in the 1980s and 1990s that most articles dealing with legitimacy and associated concepts (image, reputation) were published, when purchasing departments were becoming more autonomous (van Weele, 2014). The emphasis was often to demonstrate how critical purchasing departments were to competitive advantage and that they should be recognized for this contribution as much as the other "important" departments were. As underlined by Schoenherr et al. (2012), although purchasing departments have evolved from routine and mechanical decisions to the delivery of a true competitive advantage, that literature of a few decades ago provides a good basis for further developments on the topic of "legitimacy". This paper first clarifies the concept of legitimacy; then, it identifies the dimensions of a purchasing department's internal legitimacy; finally, it provides perspectives for PSM theory[1].

Conceptual clarification

Until now, little has been published on the issue of "purchasing legitimacy"; in fact, it is mostly through concepts such as "status", "reputation", "image", and "recognition" that some authors have discussed this topic. However, these words do not have the same meaning, although they all carry an important social dimension:

- "Reputation" is based on the assessment made by individuals about other individuals or about an organization; it also depends on a person's ability to develop socially-desirable behaviors;
- "Recognition" refers to two main dimensions: one which corresponds to recognizing someone, and the other, to an effort to be recognized for one's abilities and skills (Ricoeur, 2005);
- The "image" results from an individual's perception of many tangible and intangible characteristics and attributes associated to another individual or to an organization (Dowling, 1986).

More specifically, for PSM theory, "status" describes how a purchasing department is viewed and treated by top management and other departments (Carr and Smeltzer, 1997; Paulraj et al., 2006; Tassabehji and Moorhouse, 2008; Luzzini and Ronchi, 2011), and acts "*as a precursor for many of the characteristics of purchasing that the literature considers being 'strategic'*" (Cousins et al., 2006, p. 778), while "reputation" stems from the perceived ability of this department to create value (Cavinato, 1987; Goebel et al., 2003; Chen et al., 2004). However, it appears that what some authors call "reputation" (Haynes and Helms, 1991; Eisenhardt and Schoonhoven, 1996; Goebel et al., 2003; Eltantawy et al., 2009) is called "image" by others (Carter and Narasimhan, 1996; Luzzini et al., 2012). As for "recognition", it corresponds to how other departments and top management view both the actual and the formal purchasing department's strategic roles within the organization (Carter and Narasimhan, 1996; Luzzini and Ronchi, 2011).

[1] This paper is an extension of an analysis based on a research which initially lead to an article published in the *Journal of Purchasing & Supply Management* (Tchokogué *et al.*, 2017b). It indeed makes a different contribution than does the article.

Eisenhardt and Schoonhoven (1996), as well as Chen et al. (2004), are the only authors to have discussed "purchasing legitimacy" directly, although they don't differentiate between external and internal legitimacy. Eisenhardt and Schoonhoven (1996) have specifically pointed out that when a purchasing department enters into strategic partnerships either to gain access to or to acquire unique and valuable resources, it can leverage its reputation, its status, and its legitimacy. As for Chen et al. (2004), they note that internal customer responsiveness may be considered as an "output-based competency" that indicates how well a purchasing department delivers value to internal customers, a reality which, in turn, enhances the purchasing department's reputation and its legitimacy. For these two groups of authors, "legitimacy" thus differs from reputation, and status; however, the authors provide neither a definition of legitimacy nor the factors influencing it.

Referring to authors in the field of management, it is clear that the concept of legitimacy has received significant attention from researchers in institutional theory (Suddaby and Greenwood, 2005; Golant and Sillince, 2007), and resource dependence theory (Zimmerman and Zeitz, 2002; Drees and Pursey, 2013). By adopting the resource dependence perspective, some authors have already noted that legitimacy, reputation, and status are three different – albeit important and related – dimensions of an organization's identity, and as such, are considered as key concepts in organizational theory (Bitektine, 2011). Specifically, from the resource dependence theory perspective, "*legitimacy can be considered as similar in nature to an asset, perhaps somewhat like a money, a resource an organization requires in order to operate*."(Tilling, 2004, p. 4). Since a purchasing department is a structure within an organization, we can say that the reasoning and the studies above likely apply to it as well as for an organization. Now that we have shed some light on the concepts associated to "legitimacy", we will discuss more specifically about "internal legitimacy" and its important dimensions.

Dimensions of a purchasing department's internal legitimacy

According to Suchman (1995, p. 574), who refers to organizational legitimacy: "*Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions.*" This definition could refer both to internal and external legitimacy, depending on whose constructed system of norms one refers to. Therefore, we could say that a purchasing department's *internal legitimacy level* corresponds to how significant the purchasing department's contribution is perceived to be by the other departments' managers and by top management. Legitimacy is multidimensional (Low and Johnston, 2010; Crespin-Mazet and Dontenwill, 2012); while some authors suggest two dimensions, *managerial legitimacy* (which is based on efficiency logic) and *technical legitimacy* (based on technology, quality, and qualification) (Ruef and Scott, 1998), others believe that there are rather three dimensions: pragmatic legitimacy, moral legitimacy, and cognitive legitimacy (Johnson and Holub, 2003; Zyglidopoulos, 2003; Tchokogué et al., 2017b). It is this second perspective that we are using in our research. As mentioned at the end of the previous sub-section, since a department is also a structure which is part of an organization, this reality makes it possible to apply those three dimensions to a purchasing department. Therefore, in the following paragraphs, we discuss about what these dimensions could correspond to for a purchasing department:

- *Pragmatic* legitimacy relies on the self-interest of conferring entities (Suchman, 1995; Díez-Martín et al., 2013). For instance, if other departments consider that the actions taken by the purchasing department benefit them, the purchasing department's legitimacy would be higher than if the opposite is true. Pragmatic legitimacy may result from actions taken by the purchasing department, for instance involving other departments early in the supplier selection process, ensuring continuity of supply, and partnering with key suppliers.

- Internal legitimacy could also be based on *moral* considerations, when the actions taken benefit an organization's well-being, since any system is built on social values. It also appears that a "moral orientation" reduces opportunistic behavior (Cheng and Chen, 2016). Therefore, moral legitimacy could be studied through the results obtained and the managerial procedures implemented (Bitektine, 2011). From this standpoint, some authors believe that legitimacy is a "*fit with normative values and beliefs*" (Rindova et al., 2006, p. 54). A purchasing department's moral legitimacy would then correspond to its ability to do the "right things", for instance being guided by socially-responsible purchasing (Zorzini et al., 2015), and paying higher prices in order to support local suppliers.
- As for *cognitive* legitimacy, it is related to the relationships between an organization and its partners. Cognitive legitimacy opens the door to new business opportunities and to internal as well as to external resources, something which would have been more difficult otherwise (Cruz-Suarez et al., 2014). There is also clearly a societal dimension, since cognitive legitimacy comes from the fact that judgments from others – and mostly from external stakeholders – is so important that the individuals within an organization are not even tempted to bend the rules (Palazzo and Scherer, 2006). It would then translate into the stakeholders' perception of purchasing personnel's knowledge about the environment, regulations, and legislation, as well at its ability to use those in a value-creation process. Thus, based on Eisenhardt and Schoonhoven (1996), a purchasing department's internal legitimacy is an intangible resource that can help improve the department's strategic position; legitimacy itself has no material form (Hybels, 1995; Tilling, 2004).

Therefore, as an intangible resource, internal legitimacy can be associated to the resource-based view, which has been widely developed since the 1980s, due to the seminal contribution by Penrose (1959), who ponders as to how organizations grow, based on a *reservoir* of productive resources. A resource is an essential component under an organization's control; it can be tangible (raw materials, financial, etc.) or intangible (know-how, organizational culture, etc.). Barney (1991) suggests that it is the characteristics of the resources which make it possible for organizations to build, develop, and maintain a sustainable competitive advantage; there are four characteristics which are critical to gain that advantage: its value, its rarity, its non-substitutability, and its difficulty to be duplicated. Subsequently, many articles have been published in PSM where the resource-based view was the main theory used for the research (for instance, Hult et al., 2003; Hunt and Davis, 2008; Barney, 2012; Hitt et al., 2016; Yu et al., 2017). Resources should be created and developed, not only managed; a higher level of internal legitimacy should normally result from such an approach.

There are a few studies showing a relationship between a purchasing department's contribution and value creation and/or the perception of its importance in the organization (Pearson et al., 1996; Zsidisin et al., 2003; Luzzini and Ronchi, 2011; Tchokogué et al., 2017a). While some authors consider only the other departments' perception (Pearson et al., 1996), others consider many variables (Zsidisin et al., 2003; Eltantawy, 2008). For instance, Zsidisin et al. (2003, p. 130) suggest that the perceived importance of a purchasing department within an organization rests on three main variables: "*(1) the perceived importance of purchasing and supply management by top management and peer corporate functional areas; (2) the degree to which purchasing and supply management is accountable for achieving specific, measurable goals; and (3) the strategic integration of purchasing and supply management within its own firm*". Those three variables, which correspond to the three dimensions of the purchasing department's internal legitimacy (pragmatic, moral and cognitive), allow for a clear identification of the factors used in legitimization strategies. Other studies show that the purchasing department's status, purchasers' knowledge, and collaboration with key suppliers influence purchasing maturity seen as the level of professionalism within the purchasing

department (Rozemeijer et al., 2003; Axelsson et al., 2006; Foerstl et al., 2013; Schweiger, 2016).

Clearly, a purchasing department can be considered more mature than others, based on factors such as data consolidation, performance measures, and partnering with key suppliers. These practices are a sign that a purchasing department's professionalism is increasing its professionalism, while becoming more sophisticated in operationalizing effective supplier selection, purchasing procedures, and appropriate information systems. There are also examples of purchasing departments playing a strategic role upstream from production processes, for instance by collaborating with the R&D department in new product development; in such cases, the purchasing department's maturity level would be considered "high." Similarly, based on Pearson and Gritzmacher (1990), it can be more or less sophisticated, based on the following two characteristics: (1) the organizational structure (as a proxy for the purchasing department's status), and (2) the organizational perception. Those characteristics correspond to the *purchasing department's internal legitimacy* in our study. Therefore, status and legitimacy influence each other and should be analyzed together; Table 1 summarizes the main constructs associated to these two concepts.

Through its three dimensions, a purchasing department's internal legitimacy is both part of the context for exchange and a by-product of exchanges within the organization. A low legitimacy level could ultimately lead to the outsourcing of the department's operations. Considering that internal legitimacy is so important for a purchasing department, for instance when security of supply constitutes an important contribution to the firm's competitive advantage – a key component, based on the resource-based view (Penrose, 1959; Barney, 1991) – or when the purchasing department supports business strategy by improving lead time in integrating highly-reactive suppliers (Hesping and Schiele, 2015), one could wonder which of the three dimensions (pragmatic, moral, or cognitive) a purchasing manager should emphasize, unless it's better to make efforts on all three.

Table 1 A purchasing department's status and legitimacy: concepts and constructs

Concept	Constructs	References	Definition
Purchasing department's status	Recognition	Cavinato (1987); Eisenhardt and Schoonhoven (1996); Smeltzer (1997); Goebel et al. (2003); Chen et al. (2004); Cousins *et al.* (2006); Eltantawy et al. (2009); Czinkota et al. (2014); Luzzini and Ronchi (2016)	The actual and formal recognition of the purchasing department's strategic role within the organization
	Report level	Mol (2003); Paulraj et al. (2006); Luzzini and Ronchi (2016)	Number of direct-report levels between the highest ranking member of purchasing department and the CEO
Purchasing department's internal legitimacy	Pragmatic	Tchokogué et al. (2017b)	The extent to which the purchasing's practices and results correspond to what is expected
	Moral		The extent to which supply does the "right thing", with regards to sustainability principles.
	Cognitive		Purchasing personnel's knowledge and their ability to use it in creating value

Perspectives for PSM theory

According to the vision of Penrose (1959) and Barney (1991), legitimacy can be considered an intangible resource for any organization; therefore, this is the case for a purchasing department, and our research can then be viewed from the perspective of a *resource-based view of PSM within the firm*. Based on a concept developed by Dowling and Pfeffer (1975, p. 271), we could say that a purchasing department's internal legitimacy is an organizational "*social resource.*" This approach to analyze the purchasing department's internal legitimacy has two main perspectives for PSM theory: (1) to take into consideration to a larger extent the potential impact that this department's internal legitimacy has on the activities performed within the purchasing department and on its performance; and (2) to integrate legitimization strategies within the purchasing strategy.

Impact of a purchasing department's internal legitimacy

Considering a purchasing department's internal legitimacy as an intangible resource helps to realize that the legitimization strategies should be in line with that department's identity, e.g. its development level and its personnel's abilities and knowledge. In addition, the development of a strong organizational identity as explained by Scott and Lane (2000) appears to contribute significantly to the development of individual departments. Therefore, it is important for purchasing managers to manage their department strategically, *including* in the selection and the operationalization of appropriate legitimization strategies. For instance, if the purchasing strategy is focused on global sourcing to reduce purchasing costs, it would be illogical to emphasize the moral dimension of internal legitimacy by purchasing from local suppliers who would, ultimately, represent only a small percentage of the total purchases.

Through appropriate legitimization strategies, the purchasing manager builds, step by step, a social capital based on the recognition by the other departments' managers of the appropriateness of the actions taken to increase value; this social capital is made of resources associated to detaining a lasting network of interpersonal relationships which will facilitate the purchasing manager's efforts in implementing appropriate legitimization strategies. The economic capital that it develops through managerial competencies and the expertise in selecting supplier is clearly important; however, according to the vision of Penrose (1959) and Barney (1991), it is emphasized by the ability to find supporters in the other departments, thereby contributing to an extended influence network. There is a virtuous circle for internal legitimacy: when the purchasing department is viewed as strategic, it is included in the firm's strategic planning process; then, through its practices, it can increase both its pragmatic, moral and cognitive legitimacy. However, the reverse is also true. Referring to Rowley and Moldoveanu (2003), we can say that a purchasing department builds its social identity by operationalizing its legitimization strategies with the objective of making its actions – for instance those creating value, improving customer service or being focused on sustainability – known.

Legitimization strategies within the purchasing strategy

The strategies used by purchasing managers either to gain, maintain or extend a purchasing department's internal legitimacy take different forms depending on which legitimacy dimension they are trying to influence. According to Tilling (2004), a specific legitimization strategy can be in one of four categories: (1) establishing; (2) defending; (3) extending; or (4) maintaining legitimacy. Therefore, since purchasing managers also use legitimization strategies, the same categories could apply with regard to the purchasing department. In *establishing legitimacy*, purchasing managers should: (1) develop internal competencies, including at the relational level; and (2) ensure that the decisions and actions are in accordance with accepted standards of professionalism. In other words, legitimacy relies on an organizational isomorphism process

whereby purchasing managers rely on current norms, for instance selecting low cost suppliers in order to support a cost strategy in industries where the recognized strategy is based on cost competition. At the other end of the spectrum are purchasing departments associated to a high level of professional and relational competencies; such characteristics help create a sustainable organizational competitive advantage. In order to *maintain legitimacy* at a high level, purchasing managers then use strategies aimed at anticipating, preventing, or forestalling potential challenges.

It also seems that in many purchasing departments, the competencies do exist, but the potential contribution to providing a competitive advantage is not recognized within the organization, whether because the other departments believe that the purchasing department does not demonstrate enough moral considerations in the way it acts (*moral internal legitimacy*), or because they are not aware of that department's competencies and know-how (*cognitive internal legitimacy*). In order to change this perception (*extending legitimacy*), purchasing managers should demonstrate appropriate results more clearly, but also the purchasing department's competencies and know-how. The situation where purchasing managers have to *defend legitimacy* is quite different: the legitimacy level is high, but often due to the purchasing manager's personality or to a few persons in that department being particularly appreciated in terms of their competencies and/or collaboration. Since these people have a lot of influence, their legitimacy is confounded with the department's legitimacy. In such situations, purchasing managers should: (1) attract more high-caliber individuals in order to develop a strategic approach; (2) ensure that departmental actions are in accordance with accepted standards of professionalism.

Legitimization strategies can be grouped according to the three dimensions of internal legitimacy; as illustrated in Table 2, the operationalization of each of those dimensions is activated through different levers. Based on the resource-based view, tangible resources are mainly the purchasing department's personnel, as well as the available tools. Intangible resources are the accumulated knowledge and know-how of the purchasing team, but also their relational competencies when dealing with various stakeholders, including internal clients. Insofar as legitimacy is a resource (Suchman, 1995), the operationalization of legitimization strategies can be considered a process by which a purchasing department increases an organization's intangible resources. This is why a purchasing department's internal legitimacy should be well managed, notably by identifying the most appropriate legitimization strategies, considering which internal legitimacy level a purchasing department is already at. Since a purchasing department's legitimacy level is often associated to how much involvement its manager has in the strategic management decision making process, it should be remembered that more involvement results in a higher purchasing maturity and increases overall organizational performance (Bemelmans et al., 2013).

Table 2 Examples of legitimization strategies and the levers used for their operationalization

	Pragmatic internal legitimacy	**Moral internal legitimacy**	**Cognitive internal legitimacy**
Legitimization strategies	- Strong cost reduction orientation - Research of new raw material sources	- Development of corporate social responsibility (CSR) programs - Increase of purchases from local suppliers	- High contribution to value creation - Centralization of supply activities in the purchasing department
Levers used	- Strong managerial competencies - Recognized professional expertise	- Construction of a positive relation with suppliers - Environmentally-friendly image	- Highly-qualified personnel - Clear reporting of the department's performance

Conclusion

Although the link between "performance" and "PSM maturity" has been studied previously (Schiele, 2007; Batenburg and Versendaal, 2008; Kerfeld and Hartmann, 2010; Raschke and Ingraham, 2010; Úbeda et al., 2015; Johnsen, 2018), no detailed study exists on the steps leading to the progressive recognition of the purchasing department's contribution. One plausible explanation for this situation rests with the multidimensional character of internal legitimacy, which makes it difficult to find an appropriate approach for a solid analysis. Another possible reason for the absence of any in-depth study about a purchasing department's internal legitimacy might have to do with the fact that "internal legitimacy" is mostly associated to more general studies about tensions among functions, often in terms of intra-organizational conflicts. Actually it is Thompson (1967) who discussed about this reality, boosting knowledge in organization theory, but no researcher in the PSM field really tried to apply these concepts to the supply field.

This paper has clarified the concepts of internal legitimacy, status and reputation. In addition, we have identified that there appears to be a link between a purchasing department's development level and its internal legitimacy level. Also, we found that the achieved or expected results depend on a few important factors: (1) where the purchasing department stands at a given time in terms of the contribution perceived, similar to a "balance sheet" evaluation; (2) how quickly it evolves; and (3) the goals pursued and the efforts already made to achieve those goals. The combination of these three factors help to understand not only where a purchasing department stands at that time, but also where it will likely be in the future; actually, it might even be possible to get an impression as to how quickly the purchasing manager will get the department where he/she wants it to be. From this standpoint, our research shows that any attempt to take steps based on coherent legitimization strategies could help to improve both a purchasing department's legitimacy level and its development level.

A purchasing department, which is not considered by top management and the other departments as being strategically-oriented, has to develop legitimization strategies in order to do so and become more effective. And this brings the second major contribution which shows that by using the theoretical framework initially developed by Suchman (1995), pragmatic internal legitimacy appears to be a prerequisite to moral legitimacy; and both carry more weight than cognitive legitimacy. However, since cognitive legitimacy is not controlled by purchasing managers, it is more difficult to make the appropriate efforts to reach a higher level; actually, cognitive legitimacy can be considered as the coronation of the efforts made toward improving internal legitimacy by using multiple levers appropriately. Therefore, purchasing managers should first demonstrate concrete results, and then improve relationships with external parties such as suppliers. There is no need to spend too much time on trying to convince top management about how good the purchasing department is or can be: prove it first by acting properly on the first two dimensions; then it will be easier to achieve cognitive internal legitimacy.

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When a supplier "liberating" its organization! Consequences for the purchasing firm and the supplier-customer relationship

Thierry Allègre
Centre de Recherche sur le Transport et la Logistique / CRET-LOG
Aix-Marseille Université
413 Avenue Gaston Berger
13625 Aix-en-Provence Cedex, France
thierry.allegre@univ-amu.fr

Nathalie Merminod
Centre de Recherche sur le Transport et la Logistique / CRET-LOG
Aix-Marseille Université
413 Avenue Gaston Berger
13625 Aix-en-Provence Cedex, France
nathalie.merminod@univ-amu.fr

Abstract
In recent years, the concept of "freedom form" ("F-form") organization, proposed by Getz (2009) has been deployed timidly in firms. This approach questions intra-organizational management. According to our knowledge, no research has been conducted with a supply chain management perspective on the consequences of this "liberating" process with an inter-organizational vision. In this exploratory paper, the impacts of "liberating" a supplier on the relationship with its customer are questioned. A single case study is analysed, with the focus on the buyer's perception. Results indicate the relationship has not changed, although potential benefits could be identified.

Key words: "F-form" organization, supplier-customer relationship, transport procurement.
Topic: "supplier relationship management"
Working paper

Introduction

In recent years, the concept of “freedom form” or “F-form” organization has been deployed timidly in firms. Beyond the philosophy of the concept proposed by Getz (2009), this approach questions intra-organizational management. The proposition is to end Taylorism, pyramidal and hierarchical firms, although it particularly hurts the intermediate levels of management by proposing the sharing of objectives and responsibilities. According to Bismuth (2015), seven points differentiate the F-form company from a "traditional" company: combining well-being at work and productivity, having a shared vision given by a charismatic, exemplary and humble leader, having shared values, ending with long control loops, making actors autonomous, adopting the principle of subsidiarity and reversing the managerial pyramid. The importance of self-governance should strengthen employee involvement (Laloux, 2014). Criticisms of the model are numerous, especially related to the place accorded to employees in this approach and the consequences of a stronger empowerment. One of the major criticism is the full power that seems to be given to the charismatic leader who carries the project, Geuze (2015) going as far as to mention this approach as a "communication strategy and imposture".

Beyond conflicts and positions taken by the authors in favour of or in opposition to the concept, research is done on the impact of this approach in an intra-organizational vision. For example, the construction of new collective skills within organizations is questioned (Dufresne, 2017). However, according to our knowledge, no research has been conducted with a supply chain management perspective on the consequences of this "liberating" process with an inter-organizational vision. We propose to answer the following research question: which are the impacts of "liberating" a supplier on the relationship with its customer, taking into account the perception of the purchasing firm?

The methodology is a single case study with primary data collection (semi-structured interviews) and secondary data collection (data resulting in particular from the communication made by the supplier company in media). The results focus on the buyer's perception of the relationship with its supplier. In the first part, we discuss the concept of F-form organization. Then, the methodology and the results from the case study are presented. The conclusion allows us to make managerial recommendations as well as to identify limits and research proposals.

The “freedom-form” or “F-form” organization and the “liberating” process

The concept of “F-form” company, defined in Carney and Getz's book, *Freedom, Inc.*, published in 2009 and which quickly became a best-seller in management, has been the subject of dozens of press articles, TV reports and has generated a real buzz on social networks (Dortier, 2016). However, the dimensions of the concept are not new in themselves, and Mayo, as early as the 1930s, highlights the importance of the human factor in industrial success, thus counterbalancing the Taylorism model (Mayo, 1949). In the same view, other approaches can be mentioned, such as Theory X by Mc Gregor (1960), the H firm (Western firm with a vertical model) and J firm (Japanese firm with a horizontal model) by Oaki (1986) or the approach that appeared in the 1980s on participatory management, in line with another bestseller, written by Peters and Waterman (1982), *In Search of Excellence*. Therefore, the dimensions of the concept will be identified, then its advantages are presented before highlighting the main criticisms in the literature review.

The F-Form” firm: definition

The first use of the term "Liberation Management" appears in Peters (1992), where this type of structure is described as an adhocracy, the firm being divided into individual micro-firms connected in a network and made up of multidisciplinary, autonomous and responsible

persons. But it is the book by Carney and Getz (2009) and the article by Getz (2009) that really put forward this notion. The media, especially in France and Germany, and the report "happiness at work" by Meissonnier (broadcasted in 2015 on the Arte TV chain) both contributed to the buzz of this concept. This interest is then perceived as a proof that the F-form company would meet a real societal need (Verrier and Bourgeois, 2016).
The definition of the F-form firm, as proposed by Getz (2009, p.34) is relatively vague because this type of organization is defined by "what it is not", i.e. by a counter model with the so-called traditional Taylorism approach: (2009, p.34): "*we decided to look for the answer to this non-adoption question by narrowing down the initiative-freeing form to its radical variant, which we call F-form: an organizational form in which employees have complete freedom and responsibility to take actions that they, not their bosses, decide are best* ". The F-form firm is then not defined by its characteristics but by its "functions: "*Just are architects define human-built structures by their functions rather than by a set of structural features"* (Getz, 2009, p.35).
Through the analysis of case studies of international leading companies in their field (such as Harley Davidson and Gore), with an approach described as narrative by the authors, and in line with Maslow (1943) and McGregor (1960), Carney and Getz (2009) report that an F-form firm finds some common characteristics, such as the fact that most firms have no organizational charts, no assigned office (everyone, including the CEO just selects an open desk), many allowing employees to pick up their leaders and choose their job descriptions, and in essence invent their own jobs. Other elements, which might seem more anecdotal, are mentioned as the replacement of ceilings by stairs to increase mobility and communication between employees or the fact that there are no time clocks.

The "how" firm and the liberating process
The F-form firm can therefore be compared to the "why" company in opposition to the "how" one, also referred as the hierarchical, bureaucratic company where the "command and control" model is very present (Carney and Getz, 2009). The "why" firm is a company that relies on "*the knowledge and abilities of all employees by promoting initiative and creativity and by facilitating proactive behaviours*" (Verrier and Bourgeois, 2016, p.8).
In order to adopt this type of organization, some conditions appear fundamental. The first one is the leadership style, which is named "liberating" one Carney and Getz (2009). The second one is linked to the work conditions, namely the introduction of self-motivation (Gagné and Deci, 2005; Carney and Getz, 2009): the need for "relatedness" (need for to be treated in an intrinsically equal manner), the need for competence (need to master competencies and to increase one's skills for example), and the need for autonomy (need to be self-managed and self-directed). Leadership is therefore diffuse. The third condition is the need for the company to have a world-class vision, and the fourth one is that the company has values similar to freedom values in its history and identity (Carney and Getz, 2009).
Finally, for liberating a firm, four steps seem to emerge:
(1) The dismantling of symbols and practices that prevented employees from feeling equal (Getz, 2012) in parallel with a reduction or even elimination of common management practices (Getz, 2009).
(2) The elimination of these practices must be replaced by the vision of the leader, that he/she must share, and the implementation of shared rules of behaviour.
(3) The setting up of an environment favouring self-motivation, strongly supported by the liberating leaders.
(4) The preservation of this new culture. Two risks are raised by Carney and Getz (2009): the tendency of employees to return to a "how" firm with a "command-and-control" perspective, and the trend to think about short-term issues instead of projecting into an ambitious vision in

long term. Leaders must therefore ensure that the vision remains shared and at the heart of practices.

The criticisms of the F-form model

Several criticisms emerge. The most common one is related to the "buzz effect" of the model which would be temporary, during its implementation, like other approaches (Geuze, 2015). As Aguilar notes (2016, p.18), "critics ask "but what does the company need to free itself from?". The choice of terms may indeed raise questions. If we refer to the title of the original edition of the book published in the United States, "Free Your Employees and Let Them Lead Your Business to Higher Productivity, Profits and Growth" (Carney and Getz, 2009), we understand that it is the "liberation" of the employees that is put into question and not the firm's. Nevertheless the question remains. Would there be imprisoned employees?" Getz (2009) also mentions the need to liberate leaders. But who are these leaders and what do they need to be released from?

More generally, research on new organizational forms such as autonomous teams or management by objectives also indicates that this type of organization presents risks and potential negative consequences for employees (Ajzen, 1991). Although they focus on empowering and the autonomy of employees, they do not increase sufficiently self-autonomy but rather increase control and pressure on employees (Geary and Dobbins, 2001). In the specific case of F-form organizations, some exclusions can sometimes be observed in the liberating process (Picard, 2015, quoted by Aguilar, 2016); this phenomenon is also underlined by Aguilar (2016, p.52) in the case of Decathlon company: "*Although the F-form company says that it contributes to the well-being of employees, the discourse of the actors of the field indicates that this well-being does not concern all employees and that the approach is more suitable for certain people than for others*". Finally, there is no single path: the company that initiates a liberating process starts from its own history, from its own organization. This process, as said earlier, is largely influenced by the leader.

Research on the implementation of this approach, with an intra-organisational vision, seems to have emerged in recent years. However, to our knowledge, no research has been done on an inter-organisational approach, to identify and understand, for example, what could be the consequences of this important change, especially in a customer-supplier relationship. Yet, the implementation of Supply Chain Management (SCM) is defined by Mentzer et al. (2001, p.18) as "*the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within a supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole*". The SCM approach aims to increase value creation for end customers and significantly improve the economic performance for stakeholders, although the performance measurement issue remains unanswered (Gunasekaran et al., 2004). This collective aptitude is based on efficient management of inter-organizational interfaces. Ballou et al. (2000) support this view and postulate three dimensions of SCM, namely: (1) intra-functional coordination, (2) coordination of inter-functional activities, and (3) coordination of inter-organizational supply chain activities. The impact of a "liberating" process in a firm will conduct to changes of intra-functional coordination and inter-functional coordination inside the firm which decides to introduce this process. The impact on inter-organizational supply chain activities could be questioned in the lean vision of SCM. In this working paper and using an exploratory approach, we question the potential impacts for the customer of the company that is released. A qualitative methodology is used.

Research methods, results and managerial implications

Data collection and analysis

The first step in a research methodology is to define the unit of analysis. In this research, it is a supplier-customer relationship in the specific context when a supplier decides to modify its intra-organizational management by liberating its organization. A semi-structured interview guide has been developed prior to data collection, as suggested by Yin (2009). Three semi-structured interviews were conducted with the purchasing firm, mainly with the relationship manager, between November 2016 and January 2017. Documents related to the supplier (including media communications) as well as documents on the buyer-supplier relationship before and during the liberating process were also collected. Those documents are complementary sources of information to better understand the context of the relationship and the interfaces between the two involved companies.

As suggested by Strauss and Corbin (1990), data coding was carried out based on the literature review and the interview guide derived from it. Two researchers coded, in parallel, the full transcripts of the interviews. The coding data were compared and discussed in order to analyse the results.

Stakeholders and context of the relationship

The supplier company, which we will call F, is a provincial company. Founded in the aftermath of the Second World War, it is the subsidiary of a group specialising in services. In 2016, it achieved a turnover of more than 100 million euros. Its field of intervention is broad since it meets the needs of its clients by implementing specific solutions, in technical terms, or in terms of the expertise of the employees that it makes available to client companies. The company is particularly active in the broad distribution, construction and ready-mix concrete sectors. With a national scope, it now covers the French territory through various subsidiaries. Company F has embarked on a process of "transformation of the company" following a succession of major difficulties (human and economic) encountered in 2011, according to the director's remarks. At that time, in the spirit of management, two important elements were needed: (1) to review the organization (qualified as too hierarchical, too centralised) in order to give more power to the operational teams by freeing up initiatives, granting them the right to make mistakes; (2) to take care of employees by moving from a traditional management based on obedience and fear to a dynamic based on trust and freedom. Since 2016, as an illustration, the members of the Executive Committee have set their own annual remuneration.

Subsidiary of an international group, the client company, which has been present in France since the beginning of the 1990s, which we will call C, is specialized in the distribution of food products to the points of sale of a network present in France. To ensure its activity, C relies on distribution platforms covering France entirely. This distributor operates with its own resources (warehouse and physical distribution activities) and subcontracts part of its activity. It is in this context that F is required to provide a service on behalf of C from four of the client's platforms.

Results: study of the client-supplier relationship and its evolutions

The client-supplier relationship

The relationship between the two companies, which has also existed since the early 1990s, is a classic supplier-customer relationship. A set of specifications formalizes the expected service, which is part of the field of physical distribution. The annual business flow between these two companies is in excess of several million. Like it does for its other service providers, C evaluates F annually. The persistence of the referencing of F in time allows us to deduce that the service provided by F to C is good and economically acceptable.

The relationship has been managed by C's operations manager since 2010, who has also defined the strategy for sub-contracting and distribution of the entire company on the territory

and is therefore in a key position to maintain regular contact with transport service providers, including F, at the highest level of their organisation. The subjects raised are, classically, subjects specific to the delivery process (service quality, economic follow-up, vehicle technology, etc.), and also subjects relating to the strategic evolutions of C's business and its potential impact on the supplier's activity. From an organisational point of view, the relationship between these two companies is also made up of meetings between F's subsidiaries and the platforms on which it provides services. These meetings, which are more operational, are intended to ensure the right service level expected and deal with possible site-specific difficulties.
It was in the context of meetings between senior management teams that F mentioned, in 2012, the first initiatives linked to the transformation process towards a liberalization of the company. The Chairman himself conducted a tour of France of the various subsidiaries to meet, through meetings held outside working hours, with all his employees to explain the process. The historical nature of the relationship between C and F seems important since it reflects the maturity of the relationship and the level of trust shared between the two companies. This allows the supplier to exchange with his customer in transparency on this organizational challenge (assuming that each company has its own strategy) and for the customer to follow, with “curiosity”, the modifications made by his subcontractor. In a way that might seem paradoxical, no change is noted in the relationship between 2011 and today, despite the major transformation experienced by the subcontractor. None of the actors at C (nor the person in charge of the relationship, nor the teams present on the platforms) report any situations related to this process that could raise questions about the quality or sustainability of the relationship. The relationship seems to continue under the same conditions and in the same way as before. Finally, if the subject was not raised regularly during discussions between senior management teams, this transformation process initiated by F would seem "transparent" to C. This observation raises questions about the perceived benefits and risks.

Perceived benefits and risks
From the customer's point of view, even if this transformation may seem at this stage to have no visible impact, nevertheless consider it interesting to question on the perceived benefits and risks, when one of its suppliers engages in a process of profound transformation of its internal organization.
Perceived benefits
As mentioned above, F’s desire to migrate towards a F-form of company dates back to 2011, the first initiatives leading to collectively building (with the involvement of all employees) the new company vision in 2012. The transformation process takes time and more than five years later, the company still continues its change. The decision of such an approach must therefore be widely considered before initiating changes, since it is a long-term questioning of the traditional model. From the point of view of actors in C, the following elements can be credited as advantages:
- Transfer to a liberated form of intra-organizational enterprise
This liberating process should have the advantage of reinforcing the motivation and involvement of the employees involved in this process without excluding the probability, particularly in the upper layers of the organisation, that the model will lead to some employees questioning their future role or even incite them to leave the organisation. As stated in the literature review, a priori, such a process of organizational change strengthens employee empowerment and eliminates managerial strata. In addition, this approach involves a profound transformation of the methods and tools used in the organization. It is also and above all the opportunity for an in-depth internal questioning of the traditional organizational

model that leads to changes. The advantages perceived in the relationship by the customer are to be confronted with a subcontractor who questions itself, which in the end confers a dynamic position expected to be positive in the context of the relationship. This could potentially be opposed to other subcontractors whose traditional organization could be considered as wait-and-see to their customers.

- *Quality of service and relationship*

Service quality and the quality of the service provided on behalf of the customer must not be affected by the intra-organizational form adopted by the supplier. Indeed, whether the organisational model of the company is "liberated" or more "classical", the demand for the expected service quality level is the same. The orientation taken by the organisation of the released company should also maintain or even strengthen service quality, since this type of approach, by its very nature, favours concepts such as work-life quality, employee well-being and any other approach that tends to give a "positive" view of the working environment. The sensitivity of the organisation involved in a release process does not affect its clients here (the approach seems to be sufficiently "controlled" and progressive enough not to disturb the existing relationship). Indeed, beyond traditional operational considerations, since F has been engaged in this transformation process, at no time has it come to question this approach in the context of its activity. Subcontractor F delivers an operational service in accordance with its client's requirements.

- *Potential customer benefits generated by this transformation process*

This orientation does not seem to have an impact on "traditional" criteria for evaluating the service provided (service quality, compliance with deadlines, etc.) but could correspond more closely to issues such as work-life quality, the OHSAS 18001 standard (the certification demonstrates a commitment to occupational health and safety and a clear and proactive consideration for employees) and could be beneficial to the client on more global elements:

- *Strengthen the professionalism of supplier teams*

By a better recognition of employees within their organisation, by a stronger corporate culture that employees have appropriated, it can be considered that the organization is more sensitive in seeking customer satisfaction.

- *Offer creativity and opportunities for new services/products initiated by the supplier's team.*

The innovation approach is at the heart of this approach, by liberating the organization and giving employees the opportunity for greater accountability, the consequence is to "unbridle" the communication of ideas and facilitate their implementation. In the case of client C, the precedence of the relationship, the perfect knowledge of the processes, in a context of liberalization of the organization at F, could lead F's employees to make proposals for improvement in the specific area of service that is carried out for this client.

- *Emphasize the stability of the company's teams engaged in a transformation process.*

In the context of road freight transport, and particularly in view of the current economic situation with regard to the labour shortage affecting this sector of activity, the Fédération Nationale du Transport Routier (FNTR)[1], announces 22,363 jobs in 1,666 freight transport companies to be filled in France at the end of November 2017. However, turnover in company F is almost non-existent, and the greater involvement/ association with the company's decisions seems to have an impact on employee loyalty and therefore on the quality of the relationship for company C.

Perceived risks

[1] FNTR website : http://www.fntr.fr/lactualite/actualites/emploi-transport-routier-de-marchandises-plus-de-22-000-postes-pourvoir-en-france?field_domaine_tid=All&field_expertise_tid=All consulted on the 01/07/2018.

There are two types of perceived risks. On the one hand, there is a potential risk in the very context of the relationship. Indeed, a process of this kind leads to organizational changes that can affect individual behaviour. The customer's historical contact person can change, or even this layer of contact person can be reconsidered. Under F, the position of Director of Human Resources has been abolished, resulting in the creation of an Innovation Director. In this relationship, the director of the company has remained the privileged interlocutor of the relationship, but other interlocutors have seen their positions evolve, with responsibility becoming shared in the company: collaborative recruitment practices; and taking on tasks by some teams of decentralized employees on the client's premises that, in a traditional vision of the manager's prerogative.

On the other hand, risks can also be commercial in the medium to long term:

- A client company with a traditional organisational model and which has some difficulties understanding a supplier who would be engaged in a liberalization process: in the medium term, this can even lead to a change in the way to do business because the client company will seek a supplier with a more standard organizational model and, therefore, more compatible with this traditional vision.
- Conversely, employees representing the released company, and the strategy of the released company itself, could seek work with client and supplier companies with similar values or even similar organizational choices and thus favour the relationship with this type of company rather than with more traditional companies. At the extreme, a client company that does not meet the standards of the new form of their company could lead to a questioning of the relationship.

Conclusion: discussion and research perspectives

While the liberated business model seems to bring major intra-organizational changes for the liberating business, the case analysed here suggests a strong stability in the client-supplier relationship. It would therefore appear that the impact of this type of change in the transformation process does not shake up previously established relationships. In particular, the results indicate that even if the client company can be made aware of the changes initiated in the supplier's organization over the last few years, the relationships have not been modified. One explanation would be given by the importance of the charismatic leader, which is not considered here in a vision sometimes evoked in the model's critics as a guru or a tribunal, but rather as a real leader, recognized by his employees and customers, whose values are in adequacy with the F-form of organization he/she wishes to implement, and who remains the privileged interface for the buyer. The maintenance of traditional management tools and a classic view of the customer-supplier inter-organizational relationship, combined with a stable service level, also explains the absence of turbulence in the relationship between the company involved in this approach and its customer.

The benefits perceived by the client company are numerous and are aimed above all at a medium-term horizon. Indeed, in a sector where the labour market is under stress (difficulty in recruiting and retaining staff), companies engaged in these initiatives could attract more interest. The employees involved who, in an ambassador's logic, convey a positive image of their firm, and firms that put forward specificities different from the traditional organizational model, can make this model more attractive on the labour market due to the originality of the approach and perhaps also the notoriety induced by this approach, for example in media.

Moreover, it is essential to bear in mind that these transformation processes of the company cannot be carried out in a proselytizing way: this type of approach, especially if the company engaged in a transformation process is a supplier, must not negatively impact relations with other organizations, especially with a customer. While it is important that the steps taken

within the organization are shared, it is even more vital that the resulting organizational changes do not modify the inter-organisational framework that binds the company to its customers/suppliers, and therefore do not disrupt relations. In general, if we look at the C - F dyad, we observe that this transformation process is really only known to a small part of the employees of the client company, and objectively, with a few exceptions, the interlocutors do not seem to express a specific view about this process. It could be considered that the employees of the client company are in their position: to expect a service from a supplier, if the latter is satisfied with it, considering that the "ethical" nature of this transformation process is de facto validated by the organization since this supplier is always evaluated.

In addition, limits can be identified. The first is like Agathocle de Syracuse who, in the 4th Century BC, decided to attack Carthage in North Africa. After disembarking his troops, he burned his ships to ensure that there would be no return. The comparison may seem excessive, but such an approach, which revises the traditional organizational model of the company, will hardly suffer from a backtracking: after having liberalised (and all that this entails in terms of changes in the company's habits), is it bearable for employees to see their organization become “traditional” again?

From the customer's point of view, the dissemination of responsibilities within the organization must be sufficiently controlled so that the supplier can only speak with one voice to his customer (even if this voice is shared in the company). Indeed, the questioning of the interlocutor in the company can be a factor of destabilization, since the new organizational model can lead to a dispersion of the background and specific practices of the customer.

By questioning C on the limits that it would set for F with respect to this type of approach and more generally in relation to a subcontractor, these would most likely be oriented towards the service level and cost of service expected as well as a notion of "everyone at home". On the one hand, as long as the performance of the supplier engaged in a transformation process complies with the specifications and is economically coherent, and on the other hand, as long as the organizational changes of its subcontractor do not disturb C's intra-organizational relations, there is no reason to consider questioning the relationship between these two undertakings.

Generally speaking, this type of organizational process requires a profound challenge to the traditional model of the organization and its acceptance. It seems to us that from the point of view of the client company, as long as this process does not interfere with its own organization, it remains passive and does not seem to show any interest in the "ongoing manoeuvres" at F. More marginally, some C employees, informed of this transformation process, look with curiosity and open-mindedness at the developments that result. It seems to us, however, that this positive viewpoint cannot call into question the role of the employee of the client company: to ensure that the subcontractor delivers the service at the qualitative level and within the economic framework defined by the specifications, which limits to a pragmatic framework the relations between these two companies and any type of initiatives that could be undertaken by the subcontractor. It could be interesting for C to take ownership of these changes undertaken by its subcontractor in order to seek to maximize the positive impacts that this could have in the context of the service rendered to it. These impacts could focus on aspects of innovation (R&D), customer service, and employee initiatives on behalf of C. The criteria stemming from this transformation process, which could affect other relationships, most probably concern the subjects around empowerment, employee autonomy and their ability to take on the tasks entrusted to them more easily. Unlike a company with a traditional organization, this ability to invest, and perhaps more clearly position the notion of customer service, could lead to a form of "positive discrimination" when selecting a supplier.

This case study has the advantage of questioning the potential impacts on an inter-organizational relationship of a major intra-organizational change. The inherent limitation of

the single case study choice is that the results are necessarily circumstantial and therefore not generalizable. It would be interesting to consider other case studies, via other dyads or the study of the relations established by company F with other of its customers. It would also be interesting to continue observing the evolution of the relationship over time to see if the process initiated by F is a contributor to innovations for C. Finally, it would also be interesting to question employees interfacing in the operational relationship, within the two structures, to understand their perceptions of these changes.

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Industry 4.0 and how purchasing can progress and benefit from the fourth industrial revolution

Robbert-Jan Torn[1], Niels Pulles[2] and Holger Schiele[1]

1 University of Twente, The Netherlands

2 University of Groningen, The Netherlands

Abstract
Since its' announcement in 2011, the number of scientific publications on Industry 4.0 is growing exponentially. Significant investments by industrial firms, at present and planned for the coming years, indicate the expectations by the industry in terms of increased productivity because of the fourth industrial revolution. However, the link between purchasing and Industry 4.0 is largely lacking in scientific literature, despite the high financial impact of procurement for organizations. The fourth industrial revolution – cyber-physical systems with autonomous machine-to-machine communication – could enable several possibilities for purchasing. On the one hand support systems for purchasers are conceived, such as contract analysis software. On the other hand, the scenario of digital negotiations emerges, which could revitalize e-marketplaces. Operative processes can act autonomously, with automated demand identification in cyber-physical systems. In order to support the development of I4.0 strategies in purchasing, this paper further contributes by presenting the result of a project on developing a specific purchasing I4.0 maturity model.

Keywords: Purchasing; Supply Management; Industry 4.0; Smart Industry; Maturity profile; e-procurement; e-markets.

Introduction: Purchasing's central role in digital supply chains contrasting with a lack of specific research on I4.0's implications for purchasing

Not long after its introduction, the steam engine became the symbol for the transition from manual to mechanical labor and thereby the key technology of the first industrial revolution. Since then, two industrial revolutions followed: mass production enabled by electric power and the industrial advancements enabled by information technology. Now, a fourth industrial revolution (Industry 4.0 or I4.0) is envisioned: the merging the physical and the digital world by means of cyber-physical systems and machine-to-machine communication.

The expectations of I4.0 are high, but purchasing's contribution to its realization remains unclear. For instance, recent studies of PricewaterhouseCoopers among German industrial firms show that in the next five years, companies will invest 3.3 percent of their annual turnover in Industry 4.0 applications (Koch, Kuge, Geissbauer, & Schrauf, 2014). In addition, the Boston Consulting Group, estimated an increase in productivity of five to eight percent by adopting I4.0 (Rüßmann et al., 2015) and the Fraunhofer society expects a cumulative added value potential of 23 percent between 2013 and 2025 (Bauer, Schlund, Marrenbach, & Ganschar, 2014).

Similarly to the industry, academia regards I4.0 as a key research topic. Since 2012, the number of publications on I4.0 has rapidly increased for each consecutive year. This quick rise appears to be partly attributable to the German Government, which adopted the name for their high-tech strategy 2020 for future projects (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014). A similar trend is observed for terms related to I4.0 (Smart Industry, Smart Manufacturing, Industrial Internet, Cyber-Physical Systems). The general question is, how firms can profit from

I4.0? And how are supply chains changing in general and how could purchasing in practice contribute to seizing the chances the fourth industrial revolution if offering?

Surprisingly, while Industry 4.0 is flourishing in many streams of literature, research publications discussing I4.0's implications for purchasing seem to be largely absent from literature, as our extensive literature analysis has shown. This is a substantial gap in literature, since it is more than unlikely that the fourth industrial revolutions has no influence on purchasing theory and practice. Hence, firms, researchers and educators benefit from discussing possible scenarios of I4.0 in purchasing.

The intention of this research is to provide insight in the fourth industrial revolution and the distinction towards the third industrial revolution, followed by exploration of the relevance of purchasing with I4.0 for academics as well as practical relevance for purchasing managers. This paper aims to contribute to current literature by means of a literature review, presentation of results from more than 15 recent workshops on I4.0 in purchasing, and a design project, which summarizes findings in form of an actionable purchasing I4.0 maturity model.

First, after briefly characterizing current I4.0 research, the three preceding industrial revolution are described, whereby the technical and organizational aspects are deliberated upon. Then, the distinctive characteristics of the fourth industrial revolution as compared to the third industrial revolution (digitalization) are explained. Next, the paper focuses specifically on purchasing with I4.0 and supporting applications. Thereafter, maturity models in general, ones tailored to I4.0 and our own proposed maturity model are outlined. Closing, an agenda for future research in purchasing and a conclusion are presented to summarize the findings of this study.

Literature on Industry 4.0: absence of purchasing

Since 2015 publications on industry 4.0 and related topics have exponentially grown. To get a better understanding of the research fields that publish on the topic I4.0, we categorized publications on subject area. Table 1 makes a comparison between the subject areas of the documents found on Scopus for the four related topics. How publications are subdivided into subject areas indicates the relative importance of the subject areas for the respective topics. For clarity, the table is limited to only the top ten mentioned subject areas for I4.0. Thus, following the results in the table, publications from a business or management perspective typically connect to the term industry 4.0, compared to publications on Cyber-Physical Systems (CPS), which primarily refer to computer science.

Current frequently cited work in the field of Industry 4.0 is conducted by Kagermann et al (2013), Lee et al (2015), Lee et al. (2014), Monostori (2014), and Lasi (2014). In addition, Liao et al (2017) contributed the first published literature review on I4.0. Although the proportion of business literature on I4.0 is small, narrowed down to purchasing and I4.0, scientific literature is virtually inexistent. The query "purchasing" AND "industry 4.0" does currently not lead to any relevant results from academic search engines, and the query "purchasing 4.0" only mentions an exploratory case study classified as a master's thesis.

Table 1. Publications on Industry 4.0 and related topics in the last ten years by subject area (Reference date: January 30th, 2018; (percentages do not sum up to 100% due to overlap between subject areas)

Subject Area	Industry 4.0	Smart Industry	Smart Manufacturing	Industrial Internet	Cyber-Physical Systems
No. of publications	1958	69	480	596	7432
Engineering	65%	57%	59%	45%	74%
Computer Science	44%	56%	58%	75%	59%

Business, Management, and Accounting	16%	15%	8%	2%	8%
Decision Sciences	14%	8%	6%	4%	10%
Materials Science	12%	3%	5%	2%	8%
Mathematics	11%	8%	11%	19%	10%
Social Sciences	5%	8%	4%	4%	2%
Physics and Astronomy	5%	7%	7%	3%	3%
Chemistry	4%	-	3%	1%	2%
Energy	3%	3%	5%	3%	3%

According to the first literature review on I4.0 conducted by Liao et al. (2017) the enabling features of Industry 4.0 are the terms that most commonly appear in articles, e.g. Cyber-Physical Systems, Smart Factories, Industrial Revolutions, Internet of Things, Production Systems, Manufacturing Systems, Smart Manufacturing, Production Processes, and Cyber Physical Production Systems. In identifying the main research directions, the most-cited source at the time of writing (Kagermann et al., 2013) was referred to, which lists eight priority areas for actions. Before discussing the priority areas for action for purchasers, though, it is worth to clearly define I4.0 and distinguish the fourth from the preceding third industrial revolution.

Four industrial revolutions: Technological drivers turned into revolution by organisational changes

The industrial revolutions, so far, have been characterized a) by being ignited by new pacemaker technology, b) at first did only show slow productivity gains, which c) emerged only after reorganizing business. In the first revolution, the steam engine meant that one central power source became the center of one work environment – the first real factories emerging. The second industrial revolution is typically considered to have started in the 1860s with the advent of electricity and electrical motors. Having many decentralized power sources available, organizing production not following power transmission rules, but following a sequential logic of assembling a product became possible. The third industrial revolution, then, relied again on a new pacemaker technology, microprocessor enabled information technology, sometimes differentiated into computers and robots and called the “digital revolution” (Schuh, Potente, Varandani, Hausberg, & Fränken, 2014). Its start is typically terminated around the end of the 1960ies or the first oil price shock in 1974, which was a turning point in many aspects, for instance marking a shift in the spread of income (Greenwood, 1999; Jensen, 1993). An organizational consequence of digitalization was the reduction of variable costs. A globally accessible computer program virtually does not cost any cent more, if one or one hundred persons use it. As a consequence of reduced variable costs, a winner-takes-all economy emerged (Brynjolfsson & McAfee, 2014).

Finding new organizational forms made possible by new pacemaker technologies is exactly the challenge firms face now, at the beginning of the fourth industrial revolution.

Table 2 Industrial revolutions and key technologies.

Revolution	Pacemaker technology	Organizational transformation
First	Steam power	From decentralized manufacturing to a centralized factory
Second	Electric power (engine)	From power transmission to assembly line production
Third	Microprocessor enabled digitalization (computer, robots)	From distributed production to winner-takes-all platform monopolies
Fourth	Sensor enabled cyber-physical systems and autonomous m2m communication	?

Anatomy of the fourth industrial revolution: connecting the physical world with cyberspace

The question now is to identify the pacemaker technologies of I4.0, define industry 4.0 and, importantly, distinguish the fourth from the third revolution. A clear agreement on which would be the most important of these technologies lacks, though the literature analysis has shown that cyber-physical systems clearly get the most attention in publications. Also a widely accepted definition of I4.0 is still lacking in academia (Brettel, Friederichsen, Keller, & Rosenberg, 2014).

Several definitions for I4.0 have been proposed. Thoben et al. (2017, p. 5), for instance, define: "Industry 4.0 comprises a paradigm shift from automated manufacturing toward an intelligent manufacturing concept." It remains unclear, though, what "intelligent" may comprise. Kiel et al. (2017, p. 673) define I4.0 as " a novel manufacturing paradigm ensuring flexibility and adaptability of production systems and value chains in order to maintain the future global competitiveness of manufacturing enterprises". Here, a narrowing focus on manufacturing is given and also no clear distinction is made on what actually is ensuring flexibility; something, which has long been looked for. (Stork, 2015, p. 21) provides a detail in his attempt to define, I4.0, which in the context of purchasing studies is importance, by including the supply chain and suppliers: "The term Industry 4.0 […] refers to the "fourth industrial revolution," or the introduction of Internet technology in the manufacturing industry […] and integrate customers more closely into the product definition stage as well as business partners into the value and logistic chains." A problem with this definition, however, is the assumption of internet technology to be used, rather than other, more proprietary connectivity technologies. For data security reasons there are some serious doubts whether the relatively open internet would be the most feasible technological solution.

All in all, these definitions remain unclear in two aspects, namely in describing the constitutional elements of the fourth industrial revolution and in particular in clarifying how it differs from the previous, third industrial revolution of digitalization and automation. If the distinction between third and fourth revolution is not made clear, however, the danger remains that I3.0 applications are simply relabeled and no progress is made whatsoever. To differentiate between the industrial revolutions, we define I4.0 in the following way:

"Industry 4.0 is characterized by cyber-physical systems with autonomous machine-to-machine communication."

This definition on the one hand is not narrowing down applications by pre-defining technologies (such as claiming that the internet would be the connecting technology or that it would only refer to manufacturing) and at the same time allows to very clearly distil the novel aspects of the development inducing the next industrial revolution. There are three key concepts, which can be applied as a check-list, assessing the completeness of a vision or of a

solution provided, in terms of clarifying its progress from I3.0. In this way it becomes possible to accelerate technological progress:

(1.) Cyber-physical systems, explained as "transformative technologies for managing interconnected systems between its physical assets and computational capabilities" (J. Lee, B. Bagheri, & H. A. Kao, 2015, p. 21) stand at the core of I4.0. The particularly new feature is the connection between the physical and the digital world. The third industrial revolution introduced digital systems, which, however, did not by themselves connect to the physical world. In purchasing, the example at hand would be an electronic catalogue, which is a digital device requiring a human purchaser to enter his demand. In a cyber-physical system, on the other hand, the demand is detected by sensors, which observe that a material is running short.
(2.) Autonomy is the second of the constituting elements of I4.0 (Hwang, 2016), meaning that the system can "decide" for itself. Whether this decision is based on an pre-defined algorithms, expert systems or is based on artificial intelligence, it does not require further human intervention to function. An example would be smart machines, which can decide upon their own maintenance (Xu, 2017). In the third industrial revolution automated systems were installed. The difference to autonomous systems is that an automated system cannot react to novel situations, whereas an autonomous system reacts without external help. In purchasing, a simple application would be that a material decides on the moment of its replenishment. In an automated system (I3.O) the replenishment would work following a pre-defined plan, e.g. every first day of the month, whereas the autonomous system decides based on information it gets from the outside world when to replenish.
(3.) Machine-to-machine communication, finally, is another constitutional element, though a critical one as it requires safe communication to function (Sung, 2017). Instead of focusing on the human-machine interface, as in I3.0, now the novelty is that interconnected machines communicate with each other without requiring a human mediation. The classical case at hand are self-organized production environments, in which the machines communicate with each other and decide upon production, instead of leaving this activity to a central system. In purchasing, machine-to-machine communication would mean, for instance, that the computer of the buying firm orders material without an order from a human procurement agent.

One thing is worth to remark: While the origins of I4.0 lie in manufacturing, there is no reason as to why these principles should not apply to the entire supply chain (Tjahjono, Esplugues, Ares, & Pelaez, 2017). Therefore, it is worth (or even imperative) to explore in detail the potential implications of I4.0 also for the purchasing field.

The fourth industrial revolution in purchasing

To systematically start a discussion on I4.0's impact on purchasing, it is helpful to first briefly summarize purchasing activities and then, in a second step, based on this sequence of activities, verify the impact of industry 4.0. Regular purchasing activities can be depicted in the "purchasing year cycle". It can serve as basis for systematically assessing the I4.0 technologies' impact on purchasing.

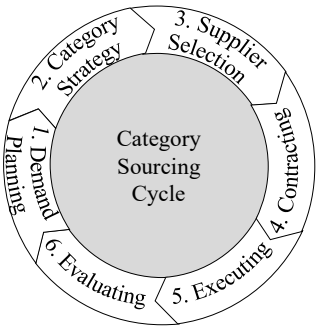

Figure 1: Purchasing year cycle (Hesping & Schiele, 2015).

Based on corporate planning that reflects the firm strategy, purchasing plans the supply for materials and services and selects and contracts suppliers (strategic sourcing; steps 1-4 in the category sourcing cycle depicted in Figure 1; Hesping & Schiele, 2015). Subsequently, these plans are executed (operative procurement step 5), and their performance is evaluated (step 6).

I4.0 applications supporting the purchasing year cycle

Implementations of I4.0 must satisfy three practical characteristics (Kagermann et al., 2013). First, horizontal integration, that is, the aggregation of distinct supportive IT systems through value networks, for instance the inclusion of suppliers of raw material or manufacturers. Second, vertical integration, meaning the integration of support IT systems used at different hierarchical levels (e.g. the sharing of data and acting upon this information during the successive stages of the manufacturing process). Third, End-to-End digital integration, the overarching aim of both horizontal and vertical integration. This refers to the integration of all functions across the entire value chain, from product design and development to production and services. End-to-end digital integration is regarded as the most difficult aspect to achieve, since it encompasses collaboration by mutually sharing digital information within and outside the firm (Kagermann et al., 2013). Concerning I4.0 implementations in purchasing and reflecting the above distinction of purchasing activities, the following paths can be suggested:

(1.) *Demand identification and planning*: Here, I4.0 technologies are not expected to show a big impact on the medium term, because the demand planning is mainly a company internal affair requiring data access on past demands, which is technically possible already by now. Next, it requires accurate sales planning, for which no I4.0 technologies have been presented, yet. One possibility, though, could rely in the use of big data analysis and artificial intelligence to improve or complement sales prognoses or to anticipate operative planning decisions (Dutta & Bose, 2015; Hofmann, Neukart, & Bäck, 2017).

(2.) *Category strategy*: Defining a category strategy follows the typical strategic management approach, requiring an internal and an external analysis. The external analysis in the case of a purchasing strategy refers to the supply market. Here, expectations are that artificial intelligence agents might be able to support supply market analysis. A data engine would collect information, while the AI would filter out those which are relevant and present them to the purchaser. The challenge lies in the learning process. How to define relevant news? And then, how to create sufficient cases so that the AI can be instructed to develop its capabilities of distinction?

(3.) *Supplier identification and selection*: In this process step, substantial achievements could be expected, exploring the ability for sophisticated text mining or artificial intelligence for analyzing the data available on suppliers (Hofmann et al., 2017). In the preparation of an RfQ it would be helpful to know all parameters of past offers, which may contain similar

parts like required. Currently such systems fail because of challenges in data classification. If this can be automatized through text mining. This could bring a break through. Based on a better knowledge on past projects, the purchaser could create a superior RfQ. Typically, then, suppliers may need some clarifications on how to respond. Here, the hope is that interactive bots could manage to answer many questions. Once the requirements are clarified, then, a big challenge for the purchaser arises: to analyze the offers submitted. Considering that offers for industrial components can easily exceed 100 pages, it becomes clear that currently a pre-selection has to take place and only a selected small number of offers can thoroughly be analyzed. The more a text mining system and in a next step an artificial intelligence can help to analyze offers and pre-select them, the more offers can be collected and seriously be considered, creating competition.

(4.) *Negotiation and contracting*: Cyber-negotiations would be a logical next step. In that case, the parties would instruct their negotiation-avatars, which would then – in thousands of iteration steps – realize the actual negotiation. At first, this process resembles an automated negotiation, as the electronic agents follow the pre-defined instructions (Cao, Luo, Luo, & Dai, 2015; Idrus, Mahmoud, Ahmad, Yahya, & Husen, 2017).There are two steps with this: at first instance, the involved parties could instruct their negotiation-avatars by establishing rules and giving clear instructions. In principle, then, pre-defined algorithms would optimize themselves. The advantage is at least fourfold: a) both, selling and buying firms have to very clearly define their expectations in order to fill in the instructions for the avatar. b) not only price becomes negotiable, but finally other criteria, which have traditionally been disregarded due to complexity, can be negotiated as well. Even fraud detection could be improved (Zhang & Liu, 2016). Different negotiation arenas can be optimized, e.g. price, diverse quality and delivery criteria, terms and conditions, liabilities etc., c) an optimum can be found, instead of just satisficing, d) there is much less danger to damage the relationship as consequence of the hard negotiations. A special challenge to be overcome here is of legal nature. For instance, who should own the data generated?

(5.) *Executing*: Cyber-physical systems could play a pivotal role in the execution phase, automatizing the demand generation in e-procurement systems, which are widely spread (Zunk, Marchner, Uitz, Lerch, & Schiele, 2014). Here, the connection between the physical world and the digital world needs to be added, for instance through devices like smart bins or sensor driven shelfs, which recognize the depletion of a store of physical objects.
In the execution phase, though of completely different nature, risk management support by artificial intelligence-driven systems. Similar to the expectation towards market analysis, a risk management system would identify and assess supply chain risks, relying on accessible data, for instance from internet resources. Another form of risk reduction could result from blockchain technology, which could find beneficial application in operative supply chains because of the creation of transparency (Tapscott & Tapscott, 2017). In case every legitimized member of a chain can access the chain data, potential delays or quality failures can already be detected early on and corrective action can be taken.

(6.) *Supplier evaluation*: Finally, in supplier evaluation an old dream of automated data analysis for evaluation could come closer. On the other hand, a more limited change impact could be expected, because such systems do not rely only on data extracted from the ERP system, but require subjective evaluations from the interface partners (in industrial applications typically next to purchasing itself, quality, logistics and engineering). These, by their nature, cannot be taken over by digital systems.

Some of the above elements could be combined, such as automatic demand generation through cyber-physical systems and cyber-negotiations. This combination could revitalize the idea of electronic market places, which failed during the “dot.com-hype” in the early 2000s,

presumably because as long as there is a human-machine interface in the moment of entering the demand into the system, an electronic market place could not offer very much more than a more comfortable paper catalogue. If demand is generated automatically and a cyper-negotiation takes place – every pencil could be negotiated, if it is electronically – emarkets could gain a new role.

Taking the perspective of a firm, the question arises how to systematically assess its potential for profiting from industry 4.0. To make a proposal for this, it could be helpful to have a maturity model, which allows to define a target to achieve and develop a step-wise roadmap to reach that goal. In order to develop this, we started a research journey.

Operationalization: A maturity model for purchasing

Method: Design case, workshops and an extensive literature review

The study originated from an aspiration to discover how purchasing can progress and benefit from the fourth industrial revolution. Several procedures were followed to ensure an academically sound prediction for the future of purchasing with I4.0. In the aim for both academic, and practical relevance, this research draws on four constructive elements: an extensive literature review; future directions for purchasing; 16 workshops on industry 4.0 application to purchasing; and a design case that integrated the preceding elements in form of a maturity model.

Starting, an exploratory approach was applied to familiarize with the topic I4.0. A systematic literature review was conducted, starting with terms including industry 4.0, smart industry, cyber-physical systems, and machine-to-machine communication. Hereby, results from Scopus were analyzed in depth to gain understanding of subject areas, geographical dispersion, frequently cited articles and authors, and the development of the number of annual results. This approach contributed to a fundament on which the design project built and contributed to the first attempt to sketch potential I4.0 applications in purchasing. The information required for this part was acquired from both academic literature as well as operational experience from the industry. Arising from the incentive to explore the future of purchasing, a total of 16 workshops on I4.0 targeted at purchasing managers were organized in Switzerland, Austria, France, Germany and Finland. Altogether more than 250 purchasers and purchasing managers attended these “fit for industry 4.0 in purchasing” workshops. Before the maturity model was constructed, alternative existing maturity models on I4.0 were analyzed and compared to identify their focus areas. The instrument was then evaluated by purchasing managers during the last two workshops. The feedback of the purchasing managers let us reconsider how advanced the first two stages of the maturity model should be.

Eight layers of industry 4.0: strategy, process, physical, p2p, kpi, sourcing, suppliers and human readiness

In developing a maturity model, a fundamental question refers to the question along which categories the maturity can be described. One approach could have been to pick the previously described purchasing year cycle and develop a scheme for each step. However, the problem with this is that often one implementation of an I4.0 tool would refer to several steps. Instead, it proved to be more operational to update a model originally conceived by Hazelaar (2016) who developed an I4.0 roadmap in indirect materials at a leading Dutch technology company.

In the context of the development, Industry 4.0 relates to implementations of machines that make decisions autonomously, facilitated by data-driven machine-to-machine communication and cyber-physical systems that convert the analyzed and communicated information to action. Nowadays, digitization takes place in business processes throughout the entire value chain instead of the role of back-office support that information technology once had (El Sawy, Malhotra, Park, & Pavlou, 2010). Despite its increased role of importance however, knowledge

regarding their level of digitization is lacking within firms (Leyh et al., 2016). As stated earlier, maturity models are helpful tools for organizations to assess their current level of development, of in this case digitization. Moreover, a practice-oriented definition of I4.0 is desired to propel further digitization in alignment with the long-term vision and strategy of organizations (Lichtblau et al., 2015).

The result of the preliminary research is the design a maturity model of eight layers: (1) strategy, (2) process, (3) physical level, (4) purchase-to-pay, (5) purchasing controlling structures, (6) sourcing, (7) supplier involvement and (8) human readiness. Within the eight layers, each item for assessment is described for four maturity levels where level one describes a pre-mature stage of I4.0, by which a lack of adoption of I4.0 concepts is meant. Level four represents world-class performance, a profound adoption of I4.0 concepts fulfilling all three constitutional criteria defined above (cyber-physical, autonomous systems and machine-to-machine communication) and alignment of concepts on a strategic level of the organization. For a more detailed overview of the maturity model see the Appendix.

1. *Strategy*: Before firms can start adapting the fourth industrial revolution, a strategy is required to prioritize the focus areas of the organization before moving towards the future desired state (Geissbauer et al., 2016). For this reason, strategy is the first layer of our maturity model. A distinction is made between an I4.0 strategy, determining requirements and priorities for the entire firm, and ultimately an I4.0 strategy tailored to purchasing. The latter is an important refinement, because strategic purchasing positively effects the financial performance of the firm (Carr & Pearson, 2002). Firms, in first instance, have to ask, if they do have an I4.0 strategy in purchasing?
2. *Process and systems*: A model that describes how to overcome the challenges of I4.0 and how to reach organizational targets is incomplete without processes that arise from the adapted strategy. At the beginning of the previous decade, the expected potential of e-procurement systems rose due to technological progression and an increased role of importance for procurement (Presutti Jr, 2003). In line with the role of procurement shifting from reducing cost to creating value, modern e-procurement systems facilitate many operational tasks, among which reducing transaction costs and increasing contract compliance, thereby saving time for purchasing personnel to concentrate on strategic, value-creating tasks (Aberdeen Group, 2005). Industry 4.0 offers improved capabilities for gathering and sharing information in real-time, and thus new opportunities for further improvement of purchasing processes. I3.0 e-procurement processes, often catalogue based, are the basis for further development into I4.0 processes, by enhancing the machine-to-machine communication and changing the interfaces to cyber-physical systems. Hence, the fundamental question for firms is to ask if they have fully implemented I3.0 (software) systems and have extended them into the physical world and autonomous connectivity? A combination of process improvement and software implementation is discussed. The two things should not be separated into two different layers in order to offer the chance and better comply to the requirement discussed above, that a technological update should lead to an organizational change, in order to generate a productivity enhancing revolution. Else, the danger arises of running again into a technology adoption paradox like in the beginning of the 1990ies (Brynjolfsson, 1993a).
3. *Physical level*: While Cyber-Physical Systems are inseparable from the fourth industrial revolution (Kagermann et al., 2013), existing maturity models only briefly mention CPS or omit the physical aspect entirely. Regarding I4.0 as a digitization solely thriving on IT-systems, Cloud, or Big Data would not do the fourth industrial revolution justice. Hence, the maturity model presented here includes a physical level. It is expected that a fusion of real and virtual systems is likely better suited to operational purchasing, for instance through self-filling systems equipped with Machine-to-Machine

communication functionality to order goods without human intervention (Fukui, 2016). In the third layer, hence, the main question firms may want to ask themselves is, where a connection to the physical world makes sense and how it is implemented? Please note that here a wide arrange of possibilities exist, starting with simple replenishment of small items in office and production, but also extending to such things as autonomous maintenance tasks.

4. *Purchase-to-pay*: Preventing or reducing, purchasing outside available contracts or 'maverick buying', is often mentioned as incentive for adopting e-procurement systems by firms (Angeles & Nath, 2007; De Boer, Harink, & Heijboer, 2002). The increased analytic and communicational capabilities associated with I4.0, such as Big Data analysis, are expected to progress contract compliance and increase automation of the payment process. The guiding question here is, in how far the P2P process of a firm is fully automatized and able to autonomously solve problems?
5. *Purchasing controlling structures*: Taking the right decisions is critical to stay in business in fast moving industries. With I4.0, end-to-end transparency of Key Performance Indicators in real-time becomes possible (Kagermann et al., 2013), which allows purchasing managers to intervene directly when needed. Hence due to its large impact on decisions, data should be carefully collected, stored, analyzed, shared and archived, and essentially treated as an asset by organizations (Wee, Kelly, Cattel, & Breunig, 2015). Nonetheless, the extended possibilities of retrieving and analyzing data also entail risks related to cyber security, for instance prevention of unauthorized access or modification of data. The question here is if the firm uses the I4.0 possibilities to collect and analyze purchasing data?
6. *Sourcing*: Data analysis based on data traffic from web shops is commonly used by companies to predict demand. For strategic purchasing, firms are expected to benefit more from data analyses when the results are shared within the organization via connected systems, this transition will require significant effort though (Geissbauer et al., 2016). Despite the expected increasing role of importance for data analytics, firms should aim for distilling useful information out of data to generate insights instead of generating as much data as possible (Lee, Lapira, Bagheri, & Kao, 2013). To provide guidance in beneficially using data for strategic purchasing, our model assesses sourcing by addressing predictive demand, market analysis, specification, and contracting including cyber-negotiations. Firms may want to assess and plan the applications of I4.0 technologies, mainly in data analysis, to support strategic sourcing?
7. *Supplier involvement*: To achieve horizontal integrated supply chains collaboration with suppliers is needed, so the willingness of suppliers to adopt I4.0 practices should be assessed in an early stage (Kagermann et al., 2013). A noticeable difference between the literature and experiences in practice is the desired level of supplier involvement. During discussions at several of our I4.0 workshop, purchasing managers indicated to be cautious about sharing data with supply chain partners. Conversely, literature deems collaborative networks essential to achieve I4.0 (Brettel et al., 2014; Geisberger & Broy, 2012). The fundamental question in this layer is if the suppliers of a firm – and in case: which – are ready to collaborate with the focal firm, as some I4.0 installations may incur substantial costs and increase competition?
8. *Human readiness*: The final layer of the model measures whether employees are ready for adopting I4.0. Other models support the importance of training personnel to achieve the necessary skill set (Geissbauer et al., 2016; Jodlbauer & Schagerl, 2016; Lichtblau et al., 2015; Schumacher et al., 2016). In our model a distinction is made between the expected required capabilities for employees and the degree of involvement of

employees during the change process. Here, the question is how have the employees in purchasing been prepared and trained to use the new technologies?

Based on these eight layers a systematic managerial and academic discussion can be started.

Conclusion: Contributions and a research agenda for purchasing to coin the ongoing industrial revolution

In this paper, we have analyzed the potential impact of the fourth industrial revolution on purchasing and developed a maturity profile which can serve for firms to develop an I4.0 strategy. By doing so, this paper contributes at least fivefold:

(1) The Literature, so far, has largely ignored purchasing as an object or subject of the fourth industrial revolution. This paper contributes with a first attempt to systematically analyze potential chances and challenges and integrate purchasing and supply management into the discourse on I4.0.

(2) In terms of managerial contribution, here, an actionable tool is proposed, the maturity model. In this way, practitioners – but also academics – can structure their approach to seizing and understanding the I4.0 implications for purchasing.

(3) Exceeding the purchasing domain, this paper contributes by providing a systematic and actionable definition of industry 4.0, whose three constitutional elements – cyber-physical, autonomous and machine-to-machine communication – can be used to check if a potential application is really an I4.0 application and likewise can serve as guideline to develop such applications.

(4) An obstacle to the progress of I4.0 can be seen in the lack of a clear differentiation towards digitalization, the third industrial revolution. Often, "old wine is served in new bottles". This paper contributes with a clear differentiation between I3.0 and I4.0, which clarifies definitions and thus enables research progress.

(5) Finally, providing a solid embedding in the history of the industrial revolutions, this paper contributes by pointing to the need to not only implement new technologies in existing processes, but to change these processes in order to achieve productivity increase. With this reminder, we hope to be able to contribute to shorten the unproductive investment paradox phase which was typical for the beginning of each industrial revolution.

If the decision to term the recent development as "industry 4.0" and hence embed it into the tradition of industrial revolutions had not effectively already happened, this paper would have made another point to the use of this term, as the historical review makes the concept much richer than competing terms, which are much more difficult to define and to turn actionable.

However, this study has also shown that research on I4.0 in general and I4.0 in purchasing in particular is still at its infancy. Before the fourth industrial revolution really reaches its productive phase, many pieces of research remain to be done, in particular (1.) concerning the operationalization of the eight layers developed for the maturity model, (2.) the stepwise analysis of the I4.0 technologies and their applicability for purchasing, (3.) the impact I4.0 has on the skills needed for the purchaser of the future and finally, (4.) strategic implications and possible business model changes induced.

(1) Concerning the need of research on the eight layers, in terms of purchase-to-pay process the operationalization and assessment of automated demand generation through cyber-physical systems strikes out. In combination with cyber-negotiations this feature could lead to a re-vitalization of the idea of electronic market places, which would be a fruitful path for future research. What also becomes clear in the context of autonomous

negotiations, is that we need much a better understanding on negotiation theory and empirics, which has been neglected in the past.

(2) Looking at the pacemaker technologies of I4.0 and their impact on supply management, the blockchain technology would need to be better understood, as it has the potential to create the transparency in the supply chain purchasers have been dreaming of since long. Transaction costs would decrease, trade without trust could become possible and hence a profound transformation of purchasing could take place. Likewise, the application of artificial intelligence, for instance as a source providing purchasers with a series of supporting tools, like in supply risk analysis or market analysis would be an important field in need for more research. Finally, the emerging digital twin technology could have as a consequence that a product is not sold once and then disappears from sight of the producer, but could stay connected through its entire life-cycle. In that case, new contracts would have to be made, for instance covering the liability issues resulting from a life-long perspective. Purchasing needs to adopt to this novel sourcing situations, for which further research could be very fruitful. Green procurement and creedal to creedal concepts can get re-vitalized.

(3) All of this is unlikely to leave the role model and hence the skills requirements of purchasers untouched. Here, a strong need for further research emerges: which are the competences needed and how to manage the change process towards a new role? If digital and autonomous negotiations establish, the task of purchasers would move out of a direct face-to-face negotiation focus, to more a thorough and cross-functional preparation of tenders and negotiation focus. Competition would increase, then calling for a better understanding of buyer-supplier relations in order to take suppliers with.

(4) All of these changes may have strategic implications. Fruitful research with a purchasing core would have to analyze I4.0's implication for supply chain configuration and business models. Are traditionally closed supply chains disintegrating and electronic market places with constantly changing partners taking over or would, instead, even closer supply chains develop with costly software integration?

Finally, some limitations of this study and its conclusions have to be acknowledged. The novel nature of I4.0 makes it almost endemically vulnerable towards errors in judgement. For instance, the assumptions underlying the maturity model will have to be checked empirically in the time to come. The same refers to the question which technologies will actually prevail and coin the fourth industrial revolution. It could also be that our study has a bias, as most of the attendants to the many I4.0 workshops we conducted came exactly for being unsecure about the future. Maybe the more knowledgeable purchasers and their insights have thus escaped to our attention. Probably, still quite some case studies of I4.0 in purchasing have to be added, but eventually a quantification of findings needs to take place.

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Change toward Public-Private-Partnership in Strategic Public Procurement: Case study in a French State-Owned Enterprise

Pierre Minh-Hoang TRAN
CentraleSupélec

Abstract
Public procurement represents, on average in the OECD, 12% of GDP and 29% of total government expenditure (OECD, 2017). It can play a significant role on promoting innovation and sustainable development, subject to the condition to establish successful public-private partnerships (Essig and Batran, 2005). The move from an administrative, dominator/dominated relationship to a fair and goal-shared partnership is specific to each organization. Nevertheless, it requires a dedicated change management to redesign organizational procedures and ways of working. The purpose of this paper is to share a partnership-oriented procurement experience in a State-owned enterprise in France with a Kotter's (1995) approach. Its drivers, change levers and also resistances to change are addressed. The findings affirm decisive role of top management's involvement and importance of communication and training programs.
Keywords: change management; public private partnership; public procurement.

Strategic Role of Public Procurement

Public procurement (PP) is the process by which governments and other bodies under public administration (including State-Owned-Enterprises or SOEs) purchase products, services and public works. The purpose of such purchases varies from purely replenishing office supplies or refurbishing office buildings to matching national policy objectives like stimulating economic activity, protecting domestic industries or alleviating regional disparities. With government purchasers accounting for over 20% of the gross domestic product (GDP) in the US (Carter & Grimm, 2001) and 14% of GDP in the European Union (European Commission, 2016), these figures illustrate the large significance of public procurement for the economy and also indicate how the public sector can support policy objectives through public procurement.

In this perspective, public procurement is increasingly recognised as a strategic instrument and a policy lever for achieving government policy goals, such as innovation, the development of small and medium-sized enterprises (SMEs), sustainable development and social objectives like public health and greater inclusiveness (OECD, 2017). In the economy, public procurement plays an important role in promoting competitive markets (Cadwell et al., 2005).

Effectively, the importance and potential impact of the profession is obvious. Public procurement functions are indeed shifting from tactics to strategy. Duties like purchase order issuance and order tracking are being replaced by activities such as global sourcing and spend analysis (Matthews, 2005).

Public-Private Partnership (PPP)

The term Public-Private Partnership (PPP) refers to a long-term, contractually regulated cooperation between the public and private sector for the efficient fulfilment of public tasks in combining the necessary resources (e.g. knowhow, operational funds, capital, personnel) of the partners and distributing existing project risks appropriately according to the risk management competence of the project partners (Savas, 2000). PPP is mainly used to build infrastructure projects. PPP refers also to a partnership procedure where the contracting authority shall

cooperate with a company – selected in a regular competitive tender procedure – to develop a product, work or service (European Commission, 2015).

According to the Public Choice theory on contemporary macroeconomic and microeconomic external reforms, the public sector needs to reinforce more competition and their related microeconomic control mechanisms instead of bureaucratic control (Essig & Batran, 2005). Public procurement therefore attempts to adopt management methods from the private sector in order to enhance the performance of the public sector, such as outsourcing, supply chain management and closer relationships between supplier and buyer (OECD, 2017).

In fact, many of the goods and services, previously provided by public authorities are also well suited to being provided by private partners (Savas, 2000). Cooperation in PPP offers a closer relationship between markets and traditional hierarchical governance and economic advantage through the reduction of transaction costs (Parker & Hartley, 2003).

Change Management

The implementation of public-private partnership in bureaucrat institutions lead to organizational changes which are defined as premeditated, agent-facilitated interventions intended to modify organizational functioning towards a more favourable outcome (Lippit et al., 1958) and that are often conceptualized as processes.

Change process

According to Lewin (1947), planned change proceeds through three phases: unfreezing, movement, and refreezing. Based on Lewin's framework, Kotter (1995) suggested a change management model with eight steps to transforming organization in order to identify and implement the right actions during each stage and avoid common pitfalls: (1) Establishing a sense of urgency, (2) Forming a powerful guiding coalition, (3) Creating a vision, (4) Communicating the vision, (5) Empowering others to act on the vision, (6) Planning for and creating short-term wins, (7) Consolidating improvements and producing still more change, and (8) Institutionalizing new approaches.

Levers of change management

In addition to process approach, it is important also to consider the change management at the operational level in order to know whether the change is really made (Tran et al., 2012). In this perspective, Paton et al. (2008) proposed that employees' commitment, involvement and a shared perception are success guarantors for an organizational change. In order to achieve employees' understanding and adhesion, three most important levers identified are leadership (Eisenbach et al., 1999; Kotter, 1995), communication (Frahm and Brown, 2007; Klein, 1996) and training (Reed and Vakola, 2006). Sarker and Lee (2003) identify three key social enablers to implement organizational change: strong and committed leadership, open and honest communication, and a balanced and empowered implementation team.

The importance of leadership to the change management process is underscored by the fact that change, by definition, requires creating a new system and then institutionalizing the new approaches (Kotter, 1995). Brown and Eisenhardt (1997) identified three key characteristics of successful managers in continuously changing organizations. Successful managers provided clear responsibility and priorities with extensive communication and freedom to improvise.

According to Frahm and Brown (2007), organizational change communication is a crucial element in employees' receptivity to change. They suggest managers need to align employees' expectations of the change communication with understanding of the change goal. Communications are important as changes are planned and carried forth. Organizational changes often founder because not enough strategic thought is given to communicating the rationale, the progress and the impact of the change (Klein, 1996).

While the Center for Advanced Purchasing Studies has identified education as a critical area for world-class purchasers (Guinipero, 1998), Reed and Vakola (2006) suggest that training also plays an important role in organizational change. They argue that the development and piloting of the training requirements analysis process needed to be approached as a change management process. Linking the training requirements analysis process with existing organizational processes was a key factor in the success of the process and created a strategic dimension which influences levels of readiness in the organization.

Case Description

As the objective of this paper is to provide an exploratory study on the change toward PPP in a public entity, the case method is suitable. It is a structural change within a French state-owned enterprise specialized in energy production and distribution, named here ENPRODI, where the author has an opportunity to observe and analyse this organizational change so far inaccessible to scientific investigation.

In spite of its enterprise status, ENPRODI manages its strategic purchasing projects (€400,000 and beyond) in compliance with European Union's Public Procurement Directive N° 2014/25 (European Commission, 2015). Its procurement turnover is about €10 billion.

In order to foster ENPRODI performance and enhance innovation, its CPO initiated "Partnership for Productivity" program in the 2000s. This program aims to encourage innovative initiatives from SMEs suppliers throughout contractual term. Any new idea will be assessed and viable projects with high potential lead to planned cooperative actions from both parties, buyer and supplier, in order to achieve technical and financial improvements.

"Partnership for Productivity" is a PPP because leaving private suppliers to design and manage project, including the input mix. It includes also risk allocation, greater transparency.

Many changes are realized to implement this program:

Before	After
Inflexible specifications	Specifications open to optimization
Contractual clauses frozen during term	Amendments possible in case of innovative proposition approved
Contract management limited to purchase order issuance and order tracking	Contract life punctuated by meetings to discuss on innovation

Key Issues

Change process

(1) Establishing a sense of urgency: At "Partnership for Productivity" kick-off meeting, the CPO underlines the importance of developing a robust SMEs ecosystem in France, in particular in energy sector. ENPRODI signed its engagement into the Charter of Inter-Enterprise Relationship in 2010, the Charter of Innovative SMEs in 2012 and the Association of SMEs Pact in 2010.

Furthermore, public budget for utilities is downsizing. Public procurement receives from government the familiar call to "do more with less". It is urgent to make savings through technical and contractual innovations.

(2) Forming a powerful guiding coalition: A Steering Committee was created with CPO, CFO, and COO's representatives as members to communicate and promote this program at every organizational level (middle management, operational professionals).

(3) Creating a vision: It is a picture of the future. ENPRODI wants "Partnership for Productivity" program to become its pillar in terms of supply chain management and innovation

management. The program will facilitate suppliers' innovation and transform it into advantages for ENPRODI.

(4) Communicating the vision: "Partnership for Productivity" program was communicated widely to every ENPRODI's supplier at top management level. Workshops were organized, in both internal and external scopes, to understand program's objectives and mechanism. Suppliers and internal professionals are accompanied by devoted referents people.
An internal quarterly newsletter on "Partnership for Productivity" program is edited to address different topics and present success stories from divisions.

(5) Empowering others to act on the vision: In each procurement team, a senior buyer is named to be focal point for "Partnership for Productivity" program. She/he consolidates program's progress for reporting at his/her team level. She/he may give a helpful hand to colleagues to integrate program into their own procurement projects. In addition, team leader is also at everyone's disposal for any discussion and assessment of an innovative idea, from supplier or internal operational source.

Furthermore, training is a very powerful tool to implement program. Better a buyer is trained and informed, better she/he gets involved. ENPRODI's Academy of Procurement creates and offers a training session on "Partnership for Productivity" to every employee interested or involved in program. It is also an effective feedback channel to collect employees' opinion on this program throughout their experience sharing.

(6) Planning for and creating short-term wins: Every year, an Annual Meeting on "Productivity partnership" is organized and sponsored by the CPO to celebrated program's milestones and award significant successful achievements. Teams get acknowledged and motived to pursuit changes.

(7) Consolidating improvements and producing still more change: Success stories declared each year are collected, presented in program's newsletter then archived in a database available in internal network. Best practices are sectioned to integrate into program's guidebook which is reviewed once after Annual Meeting.

(8) Institutionalizing new approaches: Steering Committee organizes Senior Management Workshops to shape contractual framework and organization. New clauses on "Partnership for Productivity" are integrated in standard contract. Functional department in charge of "Partnership for Productivity" is well established in ENPRODI Procurement Direction's organigram. And "Partnership for Productivity" is now part of buyer's daily work.

Conclusion

The exploratory nature of this paper reflects a brief but rare narrative study on change management in PPP implementation. This paper seeks to highlight key role that may be played by top management in every step of change process, especially in large organization with complex contractual framework. It has aimed also to underline the importance of communication and training in change management.

I acknowledge the limitations of this study. It is a working paper summarising key issues from this case rather than attempting to validate those themes. More analyses are needed to reveal other insights.

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Research Developments in Sustainable SCM: The role of ICT

Kyriaki Tselika, Department of Agricultural, Food and Environmental Sciences, University of Perugia, Borgo XX Giugno 74, 06121 Perugia, Italy, kyriakitselika@gmail.com
Evangelia Kopanaki, Department of Business Administration, University of Piraeus, Karaoli & Dimitriou 80, Piraeus, evik@unipi.gr, 210 4142424
Nikolaos Georgopoulos, Department of Business Administration, University of Piraeus, Karaoli & Dimitriou 80, Piraeus, ngeorgop@unipi.gr, 210 4142258

Abstract

The environmental problem and the rising environmental consciousness of consumers generated the need for green supply chain management. Through the use of information and communication technologies and the development of collaborative practices companies attempt to reduce their environmental impact. As the adoption of environmental practices is increasingly more important for the sustainable development of organizations, this paper aims to study and analyze recent research developments in the field. It also aims to examine the role of new technologies in the development of green supply chains.

Keywords: Sustainable SCM, environmental practices, ICT

Introduction

Companies operating in a global competitive environment need to improve operations not only internally, but also at the level of their supply chain. Therefore, the operations optimization has moved from a specific organization to the entire supply chain (Linton *et al*., 2007). A supply chain contains various participants, such as raw material suppliers, manufacturers, final products suppliers, distributors and retailers. Supply chain management is the management of the activities taking place throughout the supply chain, starting from the purchasing of raw materials to the distribution of final products to the consumer (Sehgal, 2009; Heizer et al., 2014). The main purpose of supply chain management is to integrate all parts of the supply chain, in order to gain competitive advantage and keep the operation of the company profitable (Sehgal, 2009; Heizer et al., 2014). Therefore, contemporary supply chains need to reduce their costs, enhance their efficiency, develop collaborative practices and eventually satisfy the final consumer.

Furthermore, the environmental problem and the rising environmental consciousness of consumers generated the need for sustainable supply chain management. Sustainable supply chain management integrates the environmental, societal and economic elementsinto supply chain management from the design of the product to the reverse flow of the product after its usage (Lakshmi and Visalakshmi, 2012). In order to carry out their green vision companies should consider the environmental impact of a product from all phases of its life cycle with the objective of increasing the environmental sustainability of the whole supply chain and not only a part of it (Lakshmi and Visalakshmi, 2012; Heizer et al., 2014; McKinnon et al., 2015).

The efficiency and optimization of supply chain operations as well as the implementation of environmental practices can be supported by Information and Communication Technologies (ICT). The use of new technologies, especially of Internet-based technologies, may facilitate the exchange of real-time information between companies as well as promote sustainable development and efficient operations of organizations (Fuchs and Otto, 2015).

To address these issues, this paper examines recent research conducted in the field of ICT and green supply chain management. It focuses on the results of various European research projects and aims to examine their impact on the development of environmentally sustainable

supply chain management. It also aims to identify the main environmental practices followed by companies, as well as to examine the role of information systems and technologies at their implementation.

Therefore, the objective of this research is twofold. First, it examines recent research trends and practices related to the development of sustainable supply chain management, putting emphasis on green/environmental issues. Second, it discusses the role of technology and information systems in the development and support of these practices. The limited number of detailed studies demonstrating the role and support of information systems and technologies on sustainable supply chain management is the main reason for conducting this research.

Literature Review

The protection of the environment is an important issue concerning not only the society, but also the organizations. According to Walker et al (2008) there is an extended focus on the obligations of organisations towards the society and the environment. This has led to the adoption of the term 'sustainable development'. The World Commission Report (Brundtland, 1987) defines sustainable development as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

Sustainable development includes environmental, economic and social changes such as technological advancement, investments and institutional change that should be harmonized to support and promote present as well as future human needs. (Brundtland, 1987; Large and Thomsen, 2011). Green supply chain management integrates the element of the environmental protection in the management of the materials, products and information throughout a supply chain. The main stages of green supply chain management include (i) green product design, (ii) green procurement and inbound logistics, (iii) green manufacturing, (iv) green transportation and distribution, and (v) reverse logistics.

Environmental management practices and organization performance have been investigated and discussed by various researchers (Klassen and McLaughlin, 1996; Christmann, 2000; Lucas and Noordewier, 2016; Melnyk *et al.*, 2003; Montabon *et al*., 2007). The main issue that organizations face is how to manage the viability of the organization today without endangering the environment in the future (Wu & Pagell, 2011).

Different information systems and technologies can support the exchange of information between companies as well as promote the sustainable and efficient operations of organizations (Fuchs and Otto, 2015). There are various information systems and technologies that companies can use, such as Enterprise Resource Planning (ERP), Warehouse Management Systems (WMS) and Radio Frequency Identification (RFID) (Twist, 2004; Angeles, 2005). The use of information systems and technologies can enhance the operational performance of organisations as well as support their environmental efforts.

The technological development and the expansion of the use of the Internet in business operations have led to an increased use of software solutions and technologies in supply chain management (Helo and Szekely, 2005). According to Chou et al. (2004) the Internet facilitates business collaboration, offering low-cost, easy and real-time communication and connectivity between organisations. Web-based collaboration platforms include a set of services and functions that can be accessed through the web, assisting the collection, handling and sharing of information between the participants of the platform (Lai et al., 2012). The synchronisation and sharing of real-time information between organisations promote the operation of the supply chain as a single company, which can benefit all participants (Ross, 2003) and support their green practices (Gardas and Narkhede, 2013).

Research Approach

As mentioned before, in order to examine recent research developments in the field of green supply chain management, we examined the results of European Research Projects conducted under the FP7 and Horizon 2020 programs.

The chosen EU projects combine two important elements that have not been investigated in-depth in the past, information systems and technologies and their impact on environmental sustainability. The projects were chosen according to their degree of relevance to the fundamental objective of the research. All chosen projects develop and implement environmental practices with support by information systems and technologies in order to enhance environmental sustainability in specific supply chain stages or whole supply chains.

The research method suitable for our empirical data was interpretive case study. A case study is a practical research method that examines a subject in reality. In our research we follow a multiple case design, where the different case studies are the projects analysed.

The output of the different projects, selected for our research, is in the form of various documents, which include texts that describe the different components of the projects. The development of innovative technologies, information systems or environmental practices are described in different deliverables related to the various parts/stages of the projects. These deliverables are further categorized, based on their content, into ontologies, general aims, technical specifications, architecture and impacts of the project.

To analyse our data in-depth, we conducted an interpretive research. The theoretical foundation of interpretive research is phenomenology and hermeneutics. Hermeneutics is defined as the “theory or philosophy of the interpretation of meaning” (Bleicher, 1980). Hermeneutics is responsible for the procedure of analysing the collected data and concluding with an interpretive understanding (Butler, 1998). The perspective and understanding of the researcher is changing every time he/she reads an additional document. The researcher is reading a text repeatedly and understands more and more the meaning of the text.

A concept of hermeneutics that supports the understanding and interpretation of texts is the hermeneutic circle (Boell and Cecez-Kecmanovic, 2010). This concept involves the movement from the whole to the parts and back to the whole. This circular process is repeated until the researcher understands the texts and interprets what he reads. According to Gadamer et al. (2004) the iterations of reading the text conclude to a proper understanding and interpretation of a subject. The iterations are called interactions between the researcher and the text. The integration of the parts with the whole is essential for the appropriate interpretation of the subject.

The deliverables mentioned above constitute the parts while the projects comprise the whole. While reading the different deliverables our understanding for each project is deeper. There is a key connection between the deliverables and the projects. We read the text of a deliverable and understand better the subject (whole project), and then read the text of another deliverable and go back to the project as a whole.

Research Description and Preliminary Findings

The Framework Programmes for Research and Technological Development, also called Framework Programmes, abbreviated as FP1 to FP7, with FP8 renamed to Horizon 2020, are programmes funded by the European Union (EU), supporting the European Research Area (ERA). Horizon 2020, the biggest EU Research and Innovation programme, is the successor of FP7 with funding of around 80 billion euro for the period 2014 to 2020.

We examined completed projects from the FP7 program and projects that are still under development from the Horizon 2020 program. All the examined projects aimed at promoting the adoption of green practices of companies through the utilisation of information systems, as well as the development of innovative technologies. There were various projects for different parts of the supply chain, such as the production, but our focus was mainly on the projects referring to the logistics operations. We chose this sector for two reasons: firstly, logistics processes are an important cause of environmental pollution, and secondly, the logistics sector offers various opportunities for reducing the negative environmental impact of organisations. Therefore, from the various projects examined, we decided to use and analyse seven projects from the 7th Framework programme and six from the Horizon 2020.

The different projects analysed have various environmental objectives. Tables 1 and 2 depict the connection between the projects and the green practices that companies adopt, to support the reduction of their total environmental impact.

Green Practices / Projects	**CO2**	**Energy efficiency**	**Congestion**	**Waste**
e-SAVE	✓	✓		
CO3	✓			
i-Cargo	✓		✓	
EURIDICE	✓	✓	✓	✓
PLANTCockpit		✓		✓
SMARTFREIGHT	✓		✓	
eCoMove	✓	✓	✓	

Table 1: Connection between the FP7 Projects and their Green Practices

Green Practices / Projects	**CO2**	**Energy efficiency**	**Congestion**	**Waste**
NexTrust	✓			
U-TURN	✓		✓	
CITYLAB	✓		✓	✓
AEOLIX	✓		✓	
SELIS	✓	✓		✓
CIVITAS ECCENTRIC	✓	✓	✓	

Table 2: Connection between the Horizon 2020 Projects and their Green Practices

As demonstrated above, all FP7 and Horizon 2020 projects, except PLANTCockpit, attempt to reduce carbon dioxide emissions throughout their operation with the use of information systems and technologies. Some projects focus on the reduction of congestion, in order to reduce environmental impact, while other attempt to minimise operational waste. It should be

additionally noted that FP7 projects emphasise more on energy efficiency than Horizon 2020 projects.

The main focus of both FP7 and Horizon 2020 projects is the development of web-based communication platforms that enhance collaboration between supply chain partners. General projects' results demonstrate that the integration of different information systems and technologies, through web-based collaboration platforms, is imperative for the development of efficient of logistics operations and the exchange of information among supply chain participants. The cooperation between organisations as well as the interconnection of different information systems of organisations can lead to cost reduction, greater consumer satisfaction and reduction of the negative environmental impact of organisations.

More specifically, FP7 projects mainly focused on the development and utilization of various software solutions for the integration of individual organizations' systems such as ERP and WMS with a central platform, as well as with partners' systems. Some projects, also incorporated intelligent technologies in their technological solutions, e.g. intelligent cargo that can be identified and tracked throughout its transportation.

As Horizon 2020 is a more recent funding scheme, its projects incorporate research on more advanced technologies such as cloud-based solutions, mobile technologies, service-oriented architectures and intelligent technologies that were not widely available in the previous scheme (FP7). The solutions offered by Horizon 2020 consist of cutting-edge technologies deriving from and supporting the objectives of the individual projects. Horizon 2020 projects focus on the development of new innovative technologies, not only to reduce the negative environmental impact of companies, but also to improve the living conditions of the society as a whole, as well as enhancing the economic growth rate of European countries.

Conclusions

This paper examines current research trends on sustainable supply chain management. It identifies contemporary environmental practices and examines the role of information systems and technologies in their implementation.Our research results show that environmental sustainability in supply chains may be supported, not only by the promotion of environmental practices, but also by the development of collaborative practices and the integration of information systems and technologies.

To examine these issues we analysed the results of recent research projects conducted under the FP7 and Horizon 2020 programs. Although the objectives of the two funding schemes are similar, the implementation of Horizon 2020 projects is based on more advanced technologies, such as integrated systems, mobile applications and cloud-based solutions. Furthermore, while the FP7 puts emphasis on the use of information and communication technologies within the logistics sector, Horizon 2020 focuses on the combination of innovative technologies with the environmentally friendly aspect of the organisations' operations. Through research and innovation, and by focusing on scientific excellence, industrial leadership and societal challenges, Horizon 2020 promotes sustainable, smart and inclusive growth.

However, it should be noted that the projects conducted under the Horizon 2020 program are not completed yet. As a consequence, a more detailed analysis of the various technologies and collaboration platforms developed, as well as of the sustainable development practices suggested is still not feasible.

Nevertheless, our preliminary research results identify fundamental environmental practices and demonstrate the importance of collaborative practices and integrated technological solutions to their implementation. They can be used by practitioners as an initial guide for the

application of unified green practices solutions, supported by innovative technologies. Furthermore, they can provide a base for future research in the associated field of technological development and environmental sustainability.

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Low-tech or high-tech? Relative learning benefits of serious games for construction supply chain management

Marc van den Berg, Alexandr Vasenev, Hans Voordijk and Arjen Adriaanse

Department of Construction Management and Engineering, University of Twente. P.O. Box 217, 7500 AE Enschede, The Netherlands. Emails: m.c.vandenberg@utwente.nl, j.t.voordijk@utwente.nl, a.m.adriaanse@utwente.nl

Abstract

Serious games can enhance supply chain education regardless of their delivery format being either a low-tech (analogue) or high-tech (digital) game. There is nevertheless a lack of serious games for construction supply chain management and the relative learning benefits of both types of games remain poorly understood. As studying, deploying and developing such games also demand specific resources and efforts, researchers, educators and game designers need to weigh their preferences for either a low-tech or high-tech serious game. To provide input for such decisions, this paper first develops a high-tech game for construction supply chain management based on an existing low-tech version. Through reflecting on the use of both of these variants in an exploratory experiment with 43 PhD candidates, it is concluded that learning benefits of low-tech and high-tech serious games for construction supply chain management are comparable. These insights can help researchers, educators and game designers in selecting the most appropriate type of serious game to enhance (construction-related) supply chain education.

Keywords: *construction supply chains; education; serious games*

Introduction

Coordinating activities regardless of functional or corporate boundaries is one of the key subjects in supply chain education. This subject is particularly challenging for the construction domain due to the convergent, fragmented and instable nature of its supply chains (Vrijhoef & Koskela, 2000). Compared to other industries, the construction industry is still lagging behind in terms of supply chain practices and efficiency. The typical large quantities of waste are mostly caused by poor communication, adversarial contractual relationships, a lack of customer-supplier focus, price-based selection and ineffective use of technology (Love, Irani, & Edwards, 2004). Construction professionals urgently need practically applicable knowledge about how to improve the performance of the supply chains. That is nevertheless complex and challenging, requiring a rare combination of deep, functional expertise and broad, holistic thinking (Fawcett & McCarter, 2008).

Serious games can be useful tools in teaching such aspects of (construction) supply chain management. Traditional lecture-based teaching methods assume that students passively receive information from a lecturer and internalize it through some form of memorization (Michel, Cater, & Varela, 2009), which is insufficient to convey the complexities and multiple intertwined factors found in practice. Serious games provide an "ideal alternative method of testing … concepts in an environment that resembles realistic work situations" (Al-Jibouri & Mawdesley, 2001). They are frequently defined as "(digital) games that contribute to the achievement of a defined purpose other than mere entertainment" (Susi, Johannesson, & Backlund, 2007). Serious games offer their users an experience that is planned to be meaningful – yet have rarely been used for construction-related supply chain education.

Depending on the technology used to design such an experience, two (main) types of serious games can be distinguished: low-tech and high-tech games. We use the term *low-tech* to refer to a subset of games in which the simulated environment is represented using analogue methods (e.g. board games), whereas we use the term *high-tech* to refer to games that use digital methods (e.g. video games). Both low-tech and high-tech serious games can represent the same environment. In order to select one of these two types, researchers, educators and game designers need to understand what the relative learning benefits of one type of game over the other are. This research seeks to answer that question for the context of construction supply chain management by systematically comparing the reflections of players of both low-tech and high-tech serious games for that domain.

Theoretical framework

Universities serve a critical role in disseminating (construction) supply chain management knowledge through teaching and scholarship. Delivering supply chain education poses extraordinary challenges, but has also "exceptional potential to educate, provoke and inspire students" (Brandon-Jones, Piercy, & Slack, 2012). Over the past few decades, there has been a significant growth in universities focusing on purchasing and supply management courses. With a survey into the dominant teaching approaches, Birou, Lutz, and Zsidisin (2016) revealed that undergraduate courses in this domain tend to focus on techniques and skills, while graduate courses highlight strategy to a higher degree. Supply management educational programs thereby need to respond to changes in the business environment driven by globalization, outsourcing and e-business (Ellram & Easton, 1999; Zheng, Knight, Harland, Humby, & James, 2007). Providing important and relevant supply chain management education is thus a major challenge (Bak & Boulocher-Passet, 2013), especially for hugely fragmented industries such as construction (Bankvall, Bygballe, Dubois, & Jahre, 2010).

The traditional model of lecturing and passive learning has been dominating these educational programs. The lecture-based format, complemented with basic problem-solving assignments, seems to be a convenient and expeditious way for delivering information to large groups of students, but its efficacy is increasingly questioned (Brandon-Jones et al., 2012). This model cannot cope with the many intertwined factors found in practice (Peterson, Hartmann, Fruchter, & Fischer, 2011), is limited in illustrating complex engineering topics (Deshpande & Huang, 2009; Rojas & Mukherjee, 2005), and does not actively engage students (Michel et al., 2009). This is particularly problematic for an applied field as (construction) supply chain management, where the focus moves beyond introducing basic topics towards the application of an established body of knowledge in real-life situations. As a response, leading educational scientists such as Kolb (1984) have suggested to move towards more applied, student-centered teaching methods that actively involve learners through experiential exercises.

A serious game is such an experiential exercise. Serious games are primarily intended to enhance learning of the players through providing a realistic environment in which they can deal with situations that are impossible or impractical in the real world for time, cost or safety reasons (Hussein, 2015; Mawdesley, Long, Al-jibouri, & Scott, 2011). The theoretical basis for serious games can be found in the experiential learning theory, which sees learning as a process whereby knowledge is created through the transformation of experience (Kolb, 1984; Kolb, Boyatzis, & Mainemelis, 2001). This learning-by-doing occurs when a learner is offered a meaningful experience with appropriate feedback in a continuous process of goal-directed action. Reported benefits of serious games include positive effects on knowledge acquisition, motivation and engagement (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013) and an increase in the verisimilitude of the teaching material (Al-Jibouri & Mawdesley, 2001).

Serious games have a long-standing history in both supply chain management and construction project management education. Sterman (1989) developed the MIT Beer Game, which demonstrates the bullwhip effect and became an inspiration source for many other supply chain games for the manufacturing industries. Examples of such serious games include the Lean Leap Logistics Game (Holweg & Bicheno, 2002), the Supply Chain Puzzle Game (Fawcett & McCarter, 2008) and the Distributor Game (Corsi et al., 2006). Serious games for the construction industry have covered topics such as project planning and control (Al-Jibouri & Mawdesley, 2001), competitive bidding (Nassar, 2003) and boundary crossing in design projects (Van Amstel, Zerjav, Hartmann, Dewulf, & Van der Voort, 2016). Until recently, supply chain management concepts had nevertheless not been incorporated in serious games for the construction industry.

A first attempt to develop and test a serious game specifically for construction supply chain management was described by some of the authors of this paper (Van den Berg, Voordijk, Adriaanse, & Hartmann, 2017). Their one-player game, called Tower of Infinity, offers to act as a main contractor responsible for designing and constructing a high-rise building. The game unfolds in a number of simulated weeks in which a player needs to assign her/his available crews to Modeling, Ordering, and Assembling tasks to satisfy client requirements and make a profit. Since the game uses Lego bricks as primary game materials, we categorize it as a low-tech variant. With the intention to make supply chain management knowledge experientially available to the player, the authors concluded that players can learn about eight different strategies to achieve supply chain optimizations – grouped into: (1) coordinating design and construction tasks in a coherent manner; (2) taking constructability aspects into account when designing; and (3) continuously balancing scope, time, and cost throughout a project.

The authors acknowledged that the *relative* learning benefits of serious games like this one have nevertheless remained unclear. The *low-tech* serious game Tower of Infinity had been played and tested by 64 construction management students in the context of a master's level course, but it is unclear how their prior construction education influenced their learning perceptions. It is also unclear whether the reported learning objectives would also be achieved with a *high-tech* variant of the game. Consequentially, little is known about how players reflect on usages of either a low-tech or high-tech serious games that cover construction-related supply chain concepts.

Research methodology

The goal of this research is to compare learning benefits of a low-tech and a high-tech serious game for construction supply chain management. For the context of this study, the aforementioned low-tech serious game Tower of Infinity (Van den Berg et al., 2017) was first systematically and step-by-step digitized into a high-tech prototype. This resulted in two variants of the same game: a low-tech and a high-tech type (Figure 1). Background information about these games is presented in the next section.

We conducted an exploratory experiment with both low- and high-tech games to study differences in players' perceptions. The experiment took place during a serious gaming workshop, which was a part of an Operations Research summer school for PhD candidates. The first two authors of the paper led the workshop attended by 43 participants from around the globe. After a brief introduction to serious games in general, the participants were randomly split into two groups. Group 1 included 21 persons who individually played the low-tech variant of the serious game. Group 2, consisting of 22 persons, played the high-tech variant. The two (parallel) sessions lasted one hour each. These sessions started with a 15 minute game

explanation and ended with filling out questionnaires. Later, a plenary session followed in which the authors facilitated a structured group discussion about the two types of games.

During this serious gaming workshop, we collected data on learning benefits with a post-assessment survey – the most common assessment method (Bellotti et al., 2013). We assumed equivalence through randomization of the participants rather than pre-testing. This has the advantage of avoiding the threat to validity referred to as testing, since post-assessment results may be influenced by exposure to the same questions in a pre-assessment. Besides background information, the survey questions tried to assess learning benefits through a combination of recognized assessment methods: (i) game scores (a measure to evaluate whether the player was successful in the game), (ii) supply chain optimization strategies deployed (a measure based on earlier operationalizations of the learning objectives (Van den Berg et al., 2017)) and (iii) personal views (a measure focused on the game's perceived effectiveness). Most questions could be rated on a 5-point Likert scale (e.g. 'I recognize theoretical supply chain management concepts in the game' could be rated on a scale ranging from 'strongly disagree' to 'strongly agree').

Data analysis consisted of systematically comparing the data collected from both low-tech and high-tech groups. We entered all survey data into a database (Excel sheet). For each relevant question, we thereby excluded any missing responses from the two samples (which resulted in different degrees of freedom df per question). Assuming that the data are approximately normally distributed and have equal variances, we evaluated the learning differences between low-tech and high-tech participants with a two-tailed t-test ($\alpha = 0.05$). Based on these evaluations, we drew conclusions on the learning benefits that one type of game has over the other.

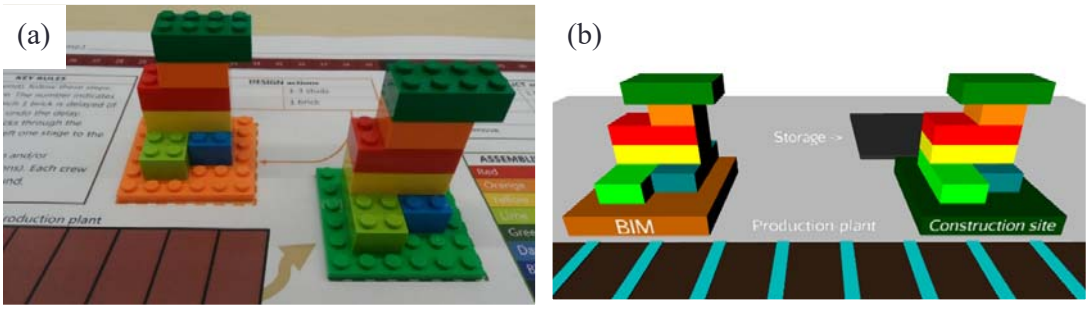

Figure 1 Prototypes of the serious game Tower of Infinity for construction-related supply chain education: (a) low-tech and (b) high-tech variants

Tower of Infinity: two variants of a construction supply chain management serious game

The serious games behind our experiment are low-tech and high-tech versions of a serious game called Tower of Infinity. Van den Berg et al. (2017) earlier developed a *low-tech* version of this game that uses Lego bricks as the main materials. This game was developed in line with the Triadic Game Design approach, which suggests that effective serious games need to balance a game concept (play), a value proposal (meaning) and a model of the real world (reality) (Harteveld, 2011). A *high-tech* variant was developed for the context of the present study by digitizing the low-tech version. This game is based on jMonkeyEngine 3.1, an open source Java-based game engine that comes with an integrated software development kit (Kusterer,

2013). The high-tech variant can be launched from a browser[1] (web start) or as a desktop executable. Players interact with the game using mouse and keyboard.

Both low-tech and high-tech Tower of Infinity variants are one-player games that put the player in the role of a main contractor responsible for designing and constructing a high-rise building. The serious games challenge players to make profits by delivering a tower according to a set of pre-defined client requirements. The two variants are intended to be played in a workshop setting, where a facilitator (acting as a client) reveals the requirements and players (each acting as a main contractor) then separately work on the project. Requirements relate to the desired number and size of the (Lego/digital) bricks and other project constraints: e.g. 'Minimally 8 RED studs', 'Finish the project within 23 weeks' and 'Build as high as possible' (hence the name of the game). The player can assign project tasks to the four multi-skilled crews assigned to the fictitious project. The three main – and subsequent – tasks include:

- Modeling: *place a 'Design' type of brick on a plane representing a virtual representation of the building (BIM);*
- Ordering: *purchase a 'Construct' type of brick by selecting one of the suppliers' offers;*
- Assembling: *place the (manufactured) 'Construct' type of brick on a plane that represents the construction site (at the same position as the corresponding design brick).*

In the high-tech version, the in-game actions (task executions) are automatically visualized in real-time at specified locations (Figure 2), while in low-tech version relevant calculations and updates are performed by players. Such, in the high-tech version, the first letter of the action is displayed in the project schedule in the color of the relevant brick. For example, when a player purchases (Orders) a red 4x2 sized brick with a lead-time of 5 weeks, a red 'O' appears in the schedule and the brick shows up at stage 5 of the conveyor belt (indicating 5 weeks to finish). When a week passes, the brick automatically moves to the next stage: in this example to stage 4 (indicating 4 weeks to finish). Delays may nevertheless randomly occur and affect the manufacturing times (yet can also be made undone at a certain cost). Productivity rates differ per type of action and per color brick. Bricks that are completely manufactured can be stored on site, yet need to be stored elsewhere (at a certain cost) with a lack of space. Ultimately, the game ends when the building matches completely with its design – at which point the player receives a notification of the profit/loss achieved.

[1] A prototypical playable version is available online at: mcvandenberg.com/game

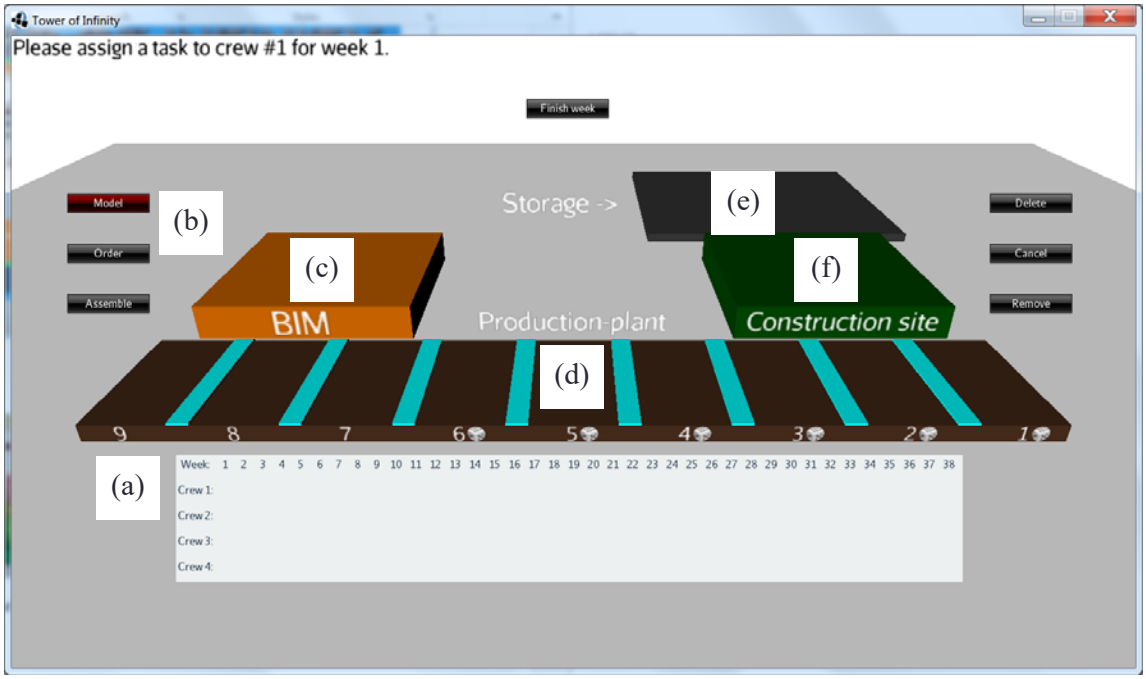

Figure 2 Overview of the high-tech version of the serious game Tower of Infinity, with: (a) a schedule with four crews available each week, (b) tasks these crews can be assigned to, (c) a Building Information Model (BIM) on which a design is created through Modeling, (d) a conveyor belt used by suppliers for manufacturing any Ordered bricks, (e) an optional external storage facility and (f) a construction site on which completed bricks are Assembled into a building

Results of an exploratory experiment

The results of the exploratory – low-tech versus high-tech – experiment are grouped into findings about game scores, supply chain optimizations and personal views. Background information of the 43 participants and their prior game experiences and (construction) supply chain management knowledge is first presented in Table 1. All participants were PhD candidates attending an Operations Research summer school and, as such, had similar educational levels and ages. There is no evidence that the two groups were different in terms of their preferences for playing board or video games, their knowledge about construction processes, supply chain management or construction-related supply chain management ($|t| \leq t_{\alpha/2}$).

Table 1 – Findings: background information rated on a 5-point Likert scale (1=strongly disagree to 5=strongly agree), with average ages of 27.5 (low-tech) and 26.5 years (high-tech)

	low-tech			*high-tech*			
	mean	*variance*	*n*	*mean*	*variance*	*n*	*t*
I like playing low-tech (board) games	4.00	0.90	21	3.83	0.50	18	0.61
I like playing high-tech (digital) games	3.60	1.20	20	3.23	1.23	22	1.09
I have good knowledge about construction processes	2.14	0.73	21	1.82	0.73	22	1.25
I have good knowledge about supply chain management	3.52	1.06	21	3.27	1.06	22	0.80
I have good knowledge about construction supply chain management	2.33	0.73	21	2.27	0.87	22	0.22

Game scores

The results of the two sessions in terms of the participants' game scores are shown in Table 2. Game scores refer to classical project management aspects: scope, time and budget. First, we found that 12 players (out of 21) finished the low-tech game and 7 (out of 22) the high-tech version. Their scores consequently represent either the 'final' game status (for those who completed it) or the 'intermediate' score (for those who did not complete it yet). The scope is operationalized as the height of the constructed tower (measured as the number of layers of bricks). Time is operationalized as the number of weeks the project was ongoing (so far). The total budget (expenses) is split in labor costs, material costs, storage rent and fees to solve delivery delays. Since the income of players was fixed at L$ 135, only projects with less than that amount of total expenses would make a profit. For all the variables identified, a two-tailed t-test was conducted. There were no significant differences found between the low-tech and high-tech groups ($|t| \leq t_{\alpha/2}$).

Table 2 – Findings: game scores, with the number of players that completely 'finished' the game being 12 (low-tech) and 7 (high-tech)

	low-tech			*high-tech*			
	mean	*variance*	*n*	*mean*	*variance*	*n*	*t*
Scope: height (including ground floor)	3.75	1.00	16	3,10	1.25	20	1,81
Time: number of weeks	22.23	14.73	13	20,42	66.37	19	0,74
Budget: total (L$)	140.14	474.44	14	156,33	2562.81	15	-1.10
- labor costs (L$)	70.59	679.26	17	92,20	492.20	5	-1,68
- material costs (L$)	38.47	47.14	17	43,25	72.25	4	-1,20
- renting temporary storage (L$)	13.57	570.88	14	6,25	156.25	4	0,58
- solving delays in deliveries (L$)	2.25	18.20	12	4,50	51.00	4	-0,78

Supply chain optimizations

The results of the strategies to achieve supply chain optimizations are shown in Table 3. Eight strategies (or learning goals) to reduce waste and/or improve efficiency had been identified in an earlier study by Van den Berg et al. (2017). Using a 5-point Likert scale, players of the low-tech and high-tech serious games answered whether they had applied these strategies. Affirmative answers (with higher ratings) thereby suggest that players were aware of the in-game learning goal. We found, among others, that the strategy 'recognizing construction sequences' scored rather high for both the low-tech ($M = 3.89; SD = 0.99$) and high-tech group ($M = 3.57; SD = 0.99$), suggesting that players adapted their designs to an efficient assembly sequence. For the optimization strategy 'making trade-offs in response to manufacturing delays', our two-tailed t-test revealed a significant difference between the low-tech group ($M = 2.72;\ SD = 1.39$) and the high-tech group ($M = 3.59; SD = 1.21$); $t = -2.41; p = 0.021$. No significant differences were found for the other optimization strategies ($|t| \leq t_{\alpha/2}$).

Table 3 – Findings: supply chain optimizations rated on a 5-point Likert scale (1=strongly disagree to 5=strongly agree)

	low-tech			*high-tech*			
	mean	*variance*	*n*	*mean*	*variance*	*n*	*t*
I used a systems perspective to focus on the entire supply chain	3.80	0.91	20	3.19	0.96	21	2.02
I tried to achieve a lean process and/or Just-In-Time deliveries	3.60	1.09	20	3.09	1.23	22	1.53
I recognized construction sequences	3.89	0.99	19	3.57	1.26	21	0.96
I adapted my strategy based on product lead-times and assembling rates	3.90	0.52	20	3.52	1.06	21	1.35
I based my design on the availability of materials and construction site characteristics	3.75	0.83	20	3.36	1.29	22	1.21
I made systematic trade-offs to fulfill client requirements	3.45	0.68	20	3.36	0.81	22	0.32
I balanced time and cost when ordering construction materials	3.25	1.46	20	3.55	1.02	22	-0.86
I made trade-offs in response to manufacturing delays	2.72	1.39	18	3.59	1.21	22	**-2.41**

Personal views

The results of participants' personal views about their (low-tech and high-tech) game experience is shown in Table 4 and Table 5. These views were linked to the three themes that are critically important in any serious game: play, meaning and reality (Harteveld, 2011). The respondents' agreements with statements related to these themes was measured with a 5-point Likert scale. Our two-tailed t-test did not reveal any significant differences between the two groups ($|t| < t_{\alpha/2}$). Three other questions invited the respondents to speculate whether they thought the version of the game that they did not play would be less (lower ratings) or more (higher ratings) fun, educative or realistic. Again, we conducted two-tailed t-tests for these variables. For the educative (meaning) theme, we found no significant differences between the two groups ($|t| \leq t_{\alpha/2}$). For the fun (play) theme, a significant difference was nevertheless found between the low-tech ($M = 3.15; SD = 0.56$) and high-tech players ($M = 3.67; SD = 0.43$); $t = -2.36; p = 0.023$. A significant difference was also observed for the realistic (reality) theme between the low-tech ($M = 3.55; SD = 0.47$) and high-tech group ($M = 2.81; SD = 0.76$); $t = 3.01; p = 0.005$.

Table 4 – Findings: personal views rated on a 5-point Likert scale (1=strongly disagree to 5=strongly agree)

	low-tech			*high-tech*			
	mean	*variance*	*n*	*mean*	*variance*	*n*	*t*
I had fun playing the game	3.48	0.96	21	3.45	1.59	22	0.06
I found the game educative with respect to construction supply chain management	3.85	0.66	20	3.95	0.90	22	-0.38
I recognize theoretical supply chain management concepts in the game	4.10	0.52	20	3.95	0.90	22	0.56
I think the game represents construction supply chain management issues realistically	3.85	0.45	20	3.86	0.50	22	-0.06

Table 5 – Findings: personal views rated on a 5-point Likert scale (1=much less to 5=much more)

	low-tech			*high-tech*			
	mean	*variance*	*n*	*mean*	*variance*	*n*	*t*
I expect that the other version of this game (i.e. low-tech or high-tech) is … fun	3.15	0.56	20	3.67	0.43	21	**-2.36**
I expect that the other version of this game (i.e. low-tech or high-tech) is … educative	3.10	0.41	20	3.05	0.65	21	0.23
I expect that the other version of this game (i.e. low-tech or high-tech) is … realistic	3.55	0.47	20	2.81	0.76	21	**3.01**

Discussion

This paper compared the relative learning benefits of serious games for construction supply chain management. Based on an (existing) low-tech serious game called Tower of Infinity, a (new) high-tech prototype was developed within the context of this study. Both types of (one-player) games aim to make construction supply chain management knowledge experientially available to their players. They do that by challenging players to maximize profit in a project that concerns the design and construction of a high-rise building. As such, these games are one of the first to incorporate supply chain management knowledge specifically for the construction industry. Documented evidence of how these types of games can enhance education had still been limited to several game workshops with a low-tech variant. This paper took a next step with comparing the learning benefits of low-tech and high-tech serious games relative to each other.

First, this paper contributes with the development of a high-tech serious game for construction supply chain management. The original, low-tech, serious game Tower of Infinity was systematically developed through analyzing three Triadic Game Design themes (Harteveld, 2011). These were also considered throughout the process of digitizing that game. As an example, play-tests with fellow researchers suggested that the initial poor usability (play) could be improved by adding a tutorial to the game. The resulting game design is a digitized variant of the Lego-based game. We have here presented an overview of this serious game and its game mechanics. The novel game provides new opportunities to acquire construction-related supply chain management knowledge.

Second, this paper contributes with insights regarding the relative benefits of low-tech and high-tech serious games for construction-related supply chain education. We conducted two-tailed t-tests for the surveyed variables to compare the learning benefits of one type of game over the other. For most of the variables, no evidence was found of differences in learning benefits. This may be explained by the fact the high-tech game is a 'direct digitization' of the low-tech variant, without many differences in appearance elements, complexity of interactions, special effects, etc. For a few variables, statistically significant differences were found. More high-tech than low-tech game players agreed that they made ‘trade-offs in response to manufacturing delays’. Such delays occur randomly and force the player to choose between ‘waiting longer’ (accepting the delay) or ‘solving the issue’ (cancelling the delay at a cost). The differences between the two groups may be explained due to the fact that low-tech game players sometimes forgot that they could cancel a delay (as was also evidenced from additional comments on the survey forms), while the high-tech game prompts that option with a kind of pop-up screen. Other differences relate to personal views. More high-tech than low-tech game players expect that the alternative version of the game would be more fun than the version they played. On the other hand, we found that more low-tech than high-tech players expect the other version of the serious game to be more realistic than their version. While the latter finding is consistent with the

common perception that ‘high-tech’ means ‘more realistic’ (Meijer, 2015), we can only speculate about the other difference.

Third, the paper contributes with a better understanding on how both low-tech and high-tech serious games may enhance (construction) supply chain education. Our analysis of post-assessment questionnaires revealed, among others, that players (from both groups) found the games ‘fun’ and that they recognized theoretical supply management lessons. The game scores revealed, however, that less players in the high-tech game group finished their game. Only few could (therefore) break down the amount of fictitious in-game money they spent into subcategories, since the prototypical game only displays that after completion. Education can also be enriched with enabling participants to actually try and experiment with strategies to optimize the performance of (construction) supply chains. For example, we found evidence for ‘recognizing construction sequences’ and ‘considering lead-times and assembly rates’. These findings further support and strengthen the conclusions of the earlier low-tech game study (Van den Berg et al., 2017).

Conclusion

Based on the results presented in this study, we conclude that the learning benefits of low-tech and high-tech serious games for construction supply chain management are comparable. Within the context of this study, a high-tech variant of the low-tech serious game Tower of Infinity was developed. Both variants were then played by two groups of (in total) 43 PhD candidates in an experimental setting. We used a post-assessment survey to capture game scores, supply chain optimization strategies and personal views. Variables within these categories were then systematically analyzed using two-tailed t-tests. From this, we conclude that learning benefits (only) differ for people playing such a low-tech or high-tech game in ‘making trade-offs in response to manufacturing delays’ (favoring the high-tech game players). We also conclude that high-tech game players expect low-tech games to be more ‘fun’ and that low-tech game players expect high-tech games to be more ‘realistic’. No other differences were found between low-tech and high-tech serious game usages, from which we suggest that the game mechanics led to similar responses rather than the game technologies deployed. More experimental research with people from different backgrounds can further strengthen these conclusions. We hope that our insights on the relative learning benefits of low-tech and high-tech serious games for construction supply chain management help other researchers, educators and game designers in selecting the most appropriate serious game technologies for their needs.

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Does controlling work? Mediated power and contractual specificity as means to align perceptions in projects

H.J. Christian van der Krift[a], Arjan J. van Weele[b], Josette M.P. Gevers[c]
Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven, The Netherlands

[a] Corresponding author: h.j.c.v.d.krift@tue.nl | +3140 247 3485
[b] a.j.v.weele@tue.nl | +3140 247 3670
[c] j.m.p.gevers@tue.nl | +3140 247 4178

Abstract

This study addresses perceptual distance between principal and agent in projects and how the principal attempts to prevent or mitigate this perceptual distance by means of control. Specifically, we investigate two controlling mechanisms: power-based control (i.e. *mediated power*) and contract-based control (*contractual specificity*) and we study how these two mechanisms influence the perceptual distance that is observed on several key relationship issues through their effect on social identification and information asymmetry. We investigate these phenomena in four rail-infrastructure projects. Based upon a cross-case comparison we can conclude that both control measures do not decrease perceptual distance; on the contrary, mediated power rather increases perceptual distance. Other findings are that *acknowledgement of power* that is held at both sides and *contractual quality* are features of the projects in which less perceptual distance is found.

Keywords: Perceptual distance, projects, collaboration

Submission category: Working paper

Introduction

A well-known Indian allegory, poeticized by John Godfrey Saxe (1868), describes how six blind men intend to discover what an elephant is. The six men approach the elephant, but due to the size of the elephant each of these men experiences a specific part of the elephant. When all return with different observations and conclusions a heated discussion begins according to Saxe (1868, pp. 260–261)[1]. The men are ignorant of each other's arguments and are convinced of being right even though they have not seen the elephant.

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[1] "*And so these men of Indostan*
Disputed loud and long,
Each in his own opinion
Exceeding stiff and strong,
Though each was partly in the right,
And all were in the wrong!
MORAL.
So, oft in theologic wars
The disputants, I ween,
Rail on in utter ignorance
Of what each other mean,
And prate about an Elephant
Not one of them has seen!"

This Indian allegory bears remarkable resemblance to project management. Namely, the elephant in this allegory is a complex project. Projects are characterized by many particularities. Therefore, these projects ask for a tailored, one-shot approach (Fulford & Standing, 2014; Segerstedt & Olofsson, 2010; Vaaland & Håkansson, 2003; Vrijhoef & De Ridder, 2005). This involves the expertise of many different organizations, contractors and subcontractors, which operate in a complex network with critical interdependencies (Bankvall, Bygballe, Dubois, & Jahre, 2010; Eriksson, 2015; Segerstedt & Olofsson, 2010; Vaaland & Håkansson, 2003). These organizations, represented by expert employees, are the Indian men in the parable. The actors all have a specific background and expertise that is of great value to the project, but also limits their perception and rationality regarding a new project. Furthermore, all actors work on a specific part at a certain hierarchical level of the entire project and, therefore, have different information and a different level of detail (Eriksson, 2015; Fulford & Standing, 2014). Hence, actors have bounded knowledge: they typically attend to only part of the project and are blind to other areas. As a result, the experts of different organizations have different perceptions which are all only a part of the truth. If not managed carefully, these different perceptions result in disputes and conflicts (Lambert, Emmelhainz, & Gardner, 1999; Rosenberg & Stern, 1971; Vaaland & Håkansson, 2003) when the actors are ignorant of the perceptions of others while each of them claims to 'know the whole truth'.

Hence, as in the allegory, conflicts between collaborating companies are not uncommon within the project and construction industry. Worse still, an increase in jurisdiction as a 'solution' to conflicts can be observed and eventually this jurisdiction can even escalate to court (Vaaland & Håkansson, 2003). This is (partially) the result of the previously mentioned one-shot approach, which results in short-term opportunistic relationships (Tazelaar & Snijders, 2010) in which collaborating companies focus on their own goals while investing limited time and resources in the joint project (Vaaland & Håkansson, 2003).

However, these days companies have to manage a broad supplier base and depend upon relationships with their strategic suppliers to realize good performance and to have competitive advantage (Kraljic, 1983; Lambert et al., 1999; Maloni & Benton, 2000; Oliver, 1990). Particularly in the project industry, where organizations need to find many partners with specific expertise in order to develop a project. Moreover, these projects nowadays regularly include design and engineering elements which increases the complexity (Vrijhoef & De Ridder, 2005). The network of supply chain relationships that has to be managed confronts buyers with considerable challenges. Specifically, the collaboration between representatives of different companies appears to be highly challenging, as they have different characteristics and cultures (Nyaga, Lynch, Marshall, & Ambrose, 2013). The cause of this challenge is that the 'merging' organizations do not recognize and accept their partners' perspectives on the collaborative project (Cartwright & Cooper, 1993). Differences in perceptions of collaborating partners is studied by Van der Krift, Van Weele and Gevers (2018) and has been referred to as perceptual distance, which they define as "*the difference between collaborating partners' perceptions of key issues in their relationship*".

In order to align perceptions buyer's representatives apply two means, namely power-based control and contract-based control. In power-based control, project managers apply mediated power in order to influence and control the dependent supplier. Mediated power is defined by Maloni and Benton (2000, pp. 54–55) as "*influence efforts that are deliberately engaged (or threatened) by the power source to guide target response*" and is seen as the negative manifestation of power (Benton & Maloni, 2005). Contract-based control refers to the practice in which project managers increase the level of contract specificity to formalize their project goals and expectations and obligations of both organizations. Through specification a mismatch

of perceptions can be prevented (Carey, Lawson, & Krause, 2011; Vaaland & Håkansson, 2003).

Despite their popularity, there is little empirical ground for the assumption that mediated power and contractual specificity can decrease perceptual distance. Therefore, in this study we aim to investigate their effectiveness in preventing or reducing perceptual distance in construction projects. This paper builds on an analysis and comparison of four rail infrastructure projects in the Netherlands. In the following, we firstly discuss the existence of perceptual distance and how mediated power and contractual specificity might influence perceptual distance in the theoretical section. Then, the methodology that is applied in this study is explicated, after which we present the results. Lastly, we discuss the results, its implications and we conclude the study in the final section.

Theoretical background

In this section, we firstly introduce the topic of perceptual distance and how this phenomenon has been explained in prior studies. Thereafter, we use the theories that are used in these studies, i.e. agency theory and social identity theory, to discuss how mediated power and contractual specificity are applied in buyer-supplier relationships to control perceptual distance. Moreover, we discuss potential effects of this mediated power and contractual specificity on perceptual distance.

Perceptual distance

Scholars have identified many relationship issues on which perceptions of collaborating partners differ. These include project objectives (Van der Krift et al., 2018), competences at either side (Homburg & Jensen, 2007; Van der Krift et al., 2018), nature or importance of regulations, trustworthiness (Andersen, Christensen, & Damgaard, 2009; Van der Krift et al., 2018), organizational responsiveness, internal task routines, and management style (Lavie, Haunschild, & Khanna, 2012; Van der Krift et al., 2018). Also other issues are proposed to be liable to perceptual distance, but research has not yet succeeded in finding perceptual distance on these issues, such as decision-making autonomy, flexibility and information exchange (Van der Krift et al., 2018).

Perceptual distance is explained by two mechanisms, namely information asymmetry and social identification (Oosterhuis, Molleman, & van der Vaart, 2013; Van der Krift et al., 2018). These two mechanisms are derived from agency theory (Eisenhardt, 1989) and social identity theory (Ashforth & Mael, 1989). Representatives of organizations are shown to have different perceptions of key relationship issues, firstly, when they do not possess the same information with regard to the project and partner involved, and secondly, when they identify themselves strongly with the interest, values and processes at their own organization. As a result of information asymmetry and social identification, collaborating partners will hold a different perspective towards the collaborative project, will interpret the behavior shown at the other organization differently, have a positive bias towards their own behavior and will more strongly identify with their own perspective (objective) and values. Altogether, these effects will cause that partners have different perceptions of key relationship issues in their collaborative project (Van der Krift et al., 2018). Because perceptual distance can have a negative effect on relational governance and project outcomes, it is important to understand what measures can prevent or reduce the emergence of perceptual distance. The aim in this study is to examine two of these measures that are applied by organizations, namely mediated power and contractual specificity.

Mediated power

Following Maloni and Benton (2000, pp. 54–55), mediated power is the attempt of the power holder (i.c. principal) to govern the behavior of the target (i.c. agent) through three types of power, namely coercive power (i.e. "*source holds ability to mediate punishment to target*"), legal power (i.e. "*source retains judiciary right to influence target*") and reward power (i.e. "*source retains ability to mediate rewards to target*"). In daily practice, this may imply that members of the powerholding company try to use this power to pursue their company's goals and interests.

When mediated power is applied by the principal in the relationship, a dependent agent likely complies with their requests (Benton & Maloni, 2005; Maloni & Benton, 2000; Nyaga et al., 2013). As a result, the behavior of the agent is aligned with the desires of the principal and perceptions are therefore well-aligned in the view of the powerholder. Overall, the agent follows the principal, in accordance with the information that is provided, wherever dictated.

However, the use of mediated power by the powerholding company might simultaneously increase issues of social identification. From a social identity theory point of view, power forms a part of the identity of the in-group and enlarges the group identification as the employees from the powerholding company can use their power to pursue their own company interests and goals (Cook, 1977; Cox, 2001). As a result, the separation of the roles of principal and agent is emphasized by the power wielded. Similarly, the employees of the other company might assume and identify with a victimized role due to being subjected to this mediated power. Consequently, the identification with the in-group increases due to the increased salience (i.e. explicit presence) of the out-group as manifested in the exercise of mediated power (Ashforth & Mael, 1989). Moreover, from the perspective of agency theory, information provides control (Eisenhardt, 1989) which is closely related to power (Cook, 1977; Maloni & Benton, 2000). The powerholder may be inclined to maliciously maintain the asymmetry of information as withholding information may provide a privileged, controlling position in the relationship. As prior studies have shown, information asymmetry is one of the mechanisms that explain the existence of perceptual distance (Oosterhuis et al., 2013; Van der Krift et al., 2018).

Hence, in the longer term the use of mediated power is believed to negatively influence the relationships because it might lead to perceptual distance (Nyaga et al., 2013), dissension (Benton & Maloni, 2005; Maloni & Benton, 2000), conflict (Benton & Maloni, 2005; Nyaga et al., 2013; Oliver, 1990) and decreased relational governance (Benton & Maloni, 2005; Nyaga et al., 2013; Terpend & Ashenbaum, 2012) and overall performance (Benton & Maloni, 2005; Maloni & Benton, 2000; Terpend & Ashenbaum, 2012). The rationale for this is that the use of mediated power indicates a focus on short-term objectives that are of interest to the power holder (Benton & Maloni, 2005; Cook, 1977; Nyaga et al., 2013). As noted earlier, particularly in projects the prevalence of short-term (usually financial) objectives is observed rather than a focus on issues that are important for maintaining a long-term relationship. This is explained by the discontinuous, one-shot approach that is found in project management (Eriksson, 2015; Fulford & Standing, 2014; Tazelaar & Snijders, 2010).

Concluding, while mediated power seems to align the behavior of the agent with the desires of the principal it may simultaneously reinforce social identification and information asymmetry in the relationship. Consequently, mediated power might influence the perceptual distance between partners in a collaborative project. The research question that we aim to answer in this paper is:

> *What effect can be expected from mediated power on the perceptual distance between buyer's and supplier's representatives in collaborative projects?*

Contractual specificity

The second means that is studied is contractual specificity, i.e. "*the extent to which contractual clauses related to obligations and behaviors are specified in detail*" (Sumo, Van der Valk, Van Weele, & Bode, 2016, p. 1483). From the perspective of agency theory, specification can be seen as a mechanism to share information and thus decrease information asymmetry between collaborating partners. By specification, the principal aims to align the expectations of principal and agent on the goals, the means and processes to obtain these goals, norms and many other contractual clauses(Carey et al., 2011). When everything is specified, both parties have the same information, and the potential of conflict will be limited between both partners (Vaaland & Håkansson, 2003).

However, contract specifications are always incomplete and subject to interpretation (Liu, Luo, & Liu, 2009) and parties may falsely believe that interpretations are aligned by having them formally stated in a contract. Thus, when detailed specifications are only limitedly discussed, it might eventually result in larger differences in opinions compared to less specific contracts where more is left for discussion and to the expertise of both partners. Moreover, leaving details unspecified may signal trust to the partner which gives the responsibility to not take advantage , whereas overly specified contracts may signal distrust (Huang, Cheng, & Tseng, 2014; Jap & Ganesan, 2000; Weber & Mayer, 2011) and might well lead parties to look for caveats in the contract and take advantage of ill-defined specifications at the expense of the other party without moral (relationship-oriented) concerns. Furthermore, from the perspective of social identity theory, the contract is an instrument that emphasizes the distinction between the role of principal and agent. Hence, the contract can stimulate the identification at both sides with their specific role. Thus, a highly specified contract makes more explicit that the collaboration is between two separate parties that both have their own interest, making them less cooperation- and trust-focused (Huang et al., 2014; Jap & Ganesan, 2000; Poppo & Zhou, 2014). Hence, by increasing the specification level both parties will more strongly identify with their own company.

Concluding, two conflicting arguments on the effects of contractual specificity seem to be provided by agency theory and social identity theory. On the one hand, contractual specificity might decrease information asymmetry between collaborating partners while on the other hand, it may increase the social identification in both groups. Hence, contractual specificity is likely to affect the level of perceptual distance, but the direction remains unclear. The research question that we aim to answer in this paper is:

> *What effect can be expected from contractual specificity on the perceptual distance between buyer's and supplier's representatives in collaborative projects?*

Methodology

Research design

To answer these research questions, the case study is a suitable method. Cases were purposefully selected based upon the variables of interest (Onwuegbuzie & Collins, 2007) which are contractual specificity and mediated power. Within these cases we gathered both quantitative data and qualitative data. The quantitative data provides us with an objective frame to compare the cases based upon the dependent variables, i.e. *perceptual distance*. The qualitative data provides us with insight in the relationship between the two means of control and perceptual distance. Furthermore, we gathered dyadic data as this study deals with perceptions of both principal and agent in collaborations. Moreover, according to Maloni and Benton (2000) dyadic data is preferred when dealing with the phenomenon of power.

Research context

Data was collected from four projects that are outsourced from a large semi-public organization in the rail-infrastructure industry in the Netherlands to one of the larger contractors in the Netherlands. The semi-public organization, which has the role of principal in these four projects, has large power because it is a significant player in the market with a market share of above 80 percent. Whereas on the supply side, there are quite some organizations competing in this industry. Hence, we can speak of a near monopsony. Furthermore, the principal uses past performance as a criterion in its tenders. This past performance is based upon evaluations on previous projects that are done by project managers at the principal's side. Although it does not necessarily imply the presence of mediated power, the use of past performance in tenders does provide the principal with a power base that approximates coercive power (i.e. bad performance in the current project will reduce the chance on getting future projects) and reward power (i.e. good performance in the current project will increase the chance of getting future projects). Therefore, it is a suitable, exemplary context to study mediated power (Onwuegbuzie & Collins, 2007). Moreover, the four projects vary in terms of size, duration and contract type for the purpose of generalizability (see Table 1). From here on, we refer to these projects as project alpha, project Bèta, project gamma and project delta respectively.

Table 1. Descriptives of the four projects that have been studied

Project	**Alpha**	**Bèta**	**Gamma**	**Delta**
Scope	Renewal and adaptation of a service center with many stakeholders	Connection of two trajectories with different voltage levels including design	The renewal of the superstructure at several locations in an important trajectory	The broadening and adaptation of a trajectory around and including a station
Selection method	Price	Best Value	Price, past performance, sustainability and safety performance	Price, past performance, sustainability and safety performance
Contract type	Specifications	Design & Construct	Design & Construct	Design & Construct
Duration	6-12 months	2-3 year	1-2 year	2-3 year
Size	€ 4 million	€ 32 million	€ 6 million	€ 28 million
Survey data sources	Principal 4, agent 5	Principal 4, agent 3	Principal 4, agent 4	Principal 3, agent 3

Data gathering

The questionnaire (see Appendix A) is based upon prior research by Van der Krift et al. (2018) but was adapted to enhance the reliability and validity of the scales. The questionnaires were gathered online. The applicant (the project manager on principal or agent side) was requested to answer five general questions with regard to the project (e.g. size, duration, type of project) and to specify the team members at both sides that were involved in the collaboration. After these questions were answered, his or her colleagues and also team members from the other organization received an invitation to fill out the questionnaire. This questionnaire consists of 103 questions regarding the relationship issues mentioned in the theoretical section of this paper and regarding mediated power. After all responses were gathered, participants received a report of the perceptions of both parties on these issues in their collaborative project. As is listed in Table 1, in total 30 responses were obtained from the four projects.

Based upon the questionnaires, individual interviews were held with the project managers on both sides separately. Hence, in total eight interviews were held. In the interviews, the relationship issues that were inquired in the questionnaire, as well as mediated power and contractual specificity were further discussed with the respondents. In Appendix A the definitions of these variables are provided. During the interviews, notes were made and proposed to the interviewee who was given the opportunity to comment on the wording. These notes have been used for the analysis section in this paper. Furthermore, the interviews were recorded to enable further analysis when needed.

Measures

The scales and definitions were mainly adopted from the paper of Van der Krift et al. (2018). However, adaptations were made to improve the validity and reliability of the scales. The scales for competences (on either side), decision-making autonomy, flexibility, and information exchange have been changed. The resulting scales are listed in Appendix A. All of the scales proved to be reliable by means of SPSS. Acceptable Cronbach's alpha values were obtained for the scales *nature of regulations*, *flexibility*, *information exchange*, and *management style* after removal of a single item.

Calculation of perceptual distance

Perceptual distance was calculated for each of the relationship issues by means of a standardized mean difference test, namely Hedges' g (Hedges, 1981; Van der Krift et al., 2018). For this calculation data was used from the responses to the questionnaire that were obtained. The visualization of perceptual distance for each of the four cases is depicted in Figure 1. From the figure we can conclude that perceptual distance is clearly found in both case Alpha and Bèta. In case Alpha large values for perceptual distance are found on many relationship issues, while in project Bèta perceptual distance is only found on a limited number of relationship issues. In cases Gamma and Delta smaller values of perceptual distance are found on several issues, but overall perceptions between collaborating partners seem to be well aligned. Consequently, we are able to compare the cases on the level of perceptual distance that is present between the collaborating partners.

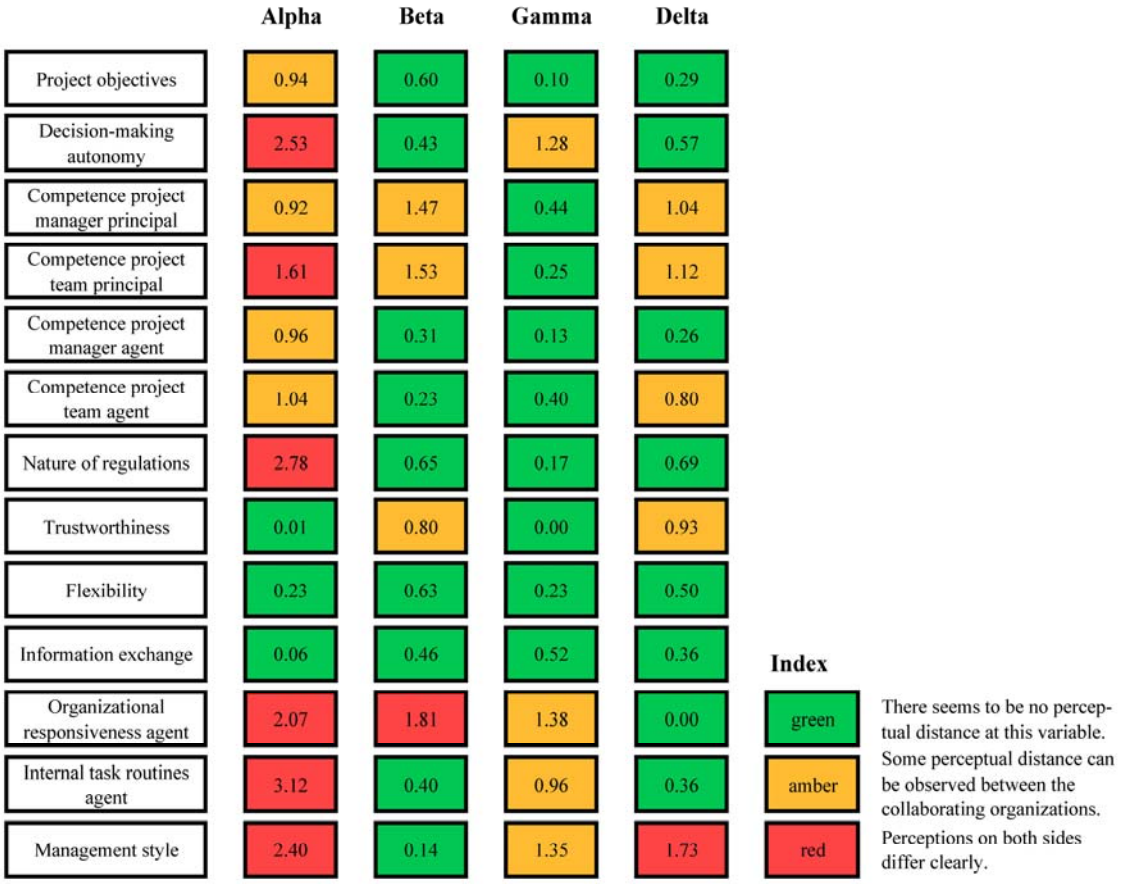

Figure 1. Perceptual distance levels on several relationship issues in the four projects; within the boxes the value for perceptual distance is found based upon Hedges' g.

Case findings

In the following section each of the four cases is analyzed. Each of the cases is shortly introduced before the application of both mediated power and contractual specificity is examined.

Project Alpha

The first project, project Alpha, concerns the renewal, adaptation and expansion of a service center. An increase of the capacity of the service center was needed as well as adaptation of the service center due to changes required for the working conditions of the service employees. These changes were required in a certain time period which has put a time pressure on the execution of the project. The overall project was not very complex in terms of technology, but involved many important stakeholders. The project had a difficult preparation process in which the first attempt to start the project had not succeeded. For the tender, specifications were developed by an external engineering office. After the bids were received, the supplier selection was fully based on price.

Mediated power

Within this project, both principal and agent indicate that the principal holds the power. The principal is decisive and determines what should be done in the project. However, while the principal says that they "*decide on the boundaries within which the agent has to do its work*" the agent makes use of a common saying which is usually linked with a traditional working

style in the construction industry, namely: "*Principal has much power. He who pays the piper calls the tune.*" In essence, the agent indicates that the principal decides on (almost) everything in this project. The project manager does so by making very explicit the distinct roles of principal and agent, and links the expected behavior to these roles. Hence, social identification is clearly present within project Alpha. While the contract type, i.e. detailed specifications, provides the principal with more power, the agent believes it has to follow the principal in its requests. From Figure 1 we can derive that principal and agent have a large perceptual distance on the decision-making autonomy of the agent. The principal perceived the agent to have much more autonomy (value of 4.95 on Likert scale) than the agent representatives perceived themselves (value of 2.68 on Likert scale). This indicates that the agent experiences the principal to have much power, manifested in the will to decide on many issues in the project. On the other hand, the principal perceives itself to make less use of its power but instead to provide autonomy to the agent. Overall, we can conclude that perceptual distance is indeed increased as a result of mediated power, through its influence on social identification.

Contractual specificity

Within project Alpha, a detailed, specified contract was expected by both parties. However, the level of detail was inconsistent over the different clauses in the contract as is indicated by representatives of the principal as well as the agent. The agent said that "*for some disciplines the contract was well-specified, but for some others it was incompletely specified.*" Hence, due to the incompleteness of the contract, information was asymmetrical between both parties. Furthermore, this incomplete specification had a major effect on the outcomes of the project according to the agent's project manager who eventually even had a loss in the project while "*there should not be any losses with this specified type of contract, because you know what has to be made* [and] *if somethings needs to be done differently, it will be settled.*" Generally, contractual specification is not believed to reduce or increase perceptual distance according to the project manager at principal, who said that "*with any type of contract, either traditional* [often described as 'technical specification' i.e. 'describing the technical properties and characteristics of what will be delivered, as well as the activities to be performed by the supplier' (Van Weele, 2014)] *or more functional* [i.e. 'describing the functionality which has to be offered to the customer' as opposed to technical specification (Van Weele, 2014)]*, there is a game between principal and agent with regard to the precise interpretation of elements from the contract.*" Hence, the interviews indicate that it is rather about *contractual quality* than about contractual specificity.

Project Bèta

Project Bèta is the largest project among the four that we have studied. The project concerns the connection of two important trajectories with different voltage levels. This connection asks for specialized engineering. Hence, it is a very complex work with regard to technology, innovation and time schedule. Because of the complexity and size of the project, the supplier was selected using the Best Value Procurement methodology (Van de Rijt & Santema, 2013). Hence, the principal did a request for proposal using a ceiling price. However, the agent was the only contractor that could deliver under this project sum defined, leaving no option to the principal other than to work with this supplier. The tender and selection method were relatively new to both sides and as a result the project managers were rather inexperienced with regard to the procedures and conditions in a project based upon this tender and selection method.

Mediated power

Project Bèta is characterized by a low use of mediated power by the principal. The project manager at the principal states that they "*must exactly not assert our authority here*" referring

to the fact that the agent has much say given the functional specifications that are provided by the principal. The tender procedure, based upon Best Value Procurement, is based upon the supposition that the agent is the expert, and, as such the agent is better in deciding what needs to be done for the best project result. As such, the agent's responsibility is to make and deliver a design to the principal. These designs and solutions did not have to be formally approved by the principal, only deviations from regulations were discussed with the principal according to the interviewees. However, while little attention was paid to the power that the principal holds the roles, responsibilities and expectations of both organizations were rather unclear. Within project Bèta, the principal requested several changes after the tender and contracting phase and during project execution. Due to the lack of attention that was paid to the power and roles of both parties, the agent followed the principal in its requests. As a result, there have been almost 300 changes in the project with, major negative consequences for project cost and schedule. Furthermore, due to the role ambiguity, at the agent they believed that information was not to be shared as they had to solve issues themselves. Logically, the large number of changes and the ambiguity in roles results in different perceptions of how the agent deals with changes. Hence, significant perceptual distance is observed on one specific variable, namely *organizational responsiveness agent*.

In project Bèta, we observe that a lower use of power has resulted in greater role ambiguity and information asymmetry, but it seems also to have led to low social identification with the own organization. As a result, some perceptual distance was found in this project Bèta.

Contractual specificity

In project Bèta specifications appeared to be rather inconsistent, notwithstanding the tender method (i.e. Best Value) and contract type (i.e. Design & Construct) that were used. According to principal's project manager "*not everything was yet straightened with this contract… Of some issues the protocols were not yet specified.*" The agent observed the same problem as was seen in project Alpha, namely that "*one section* [in the contract] *is very much specified in detail, another* [section] *is very abstract.*" According to the principal this caused quite some problems in contractual discussions. Both principal and agent agree on the fact that differences in interpretations and perceptions are not necessarily prevented by specifications in the contract. On the contrary, the agent mentioned that "*on the most specifically described section we needed most to engage in dialogue.*" Moreover, the principal states that generally "*the more functional you specify, the less chance there is of differences in interpretations because you hand more over to the agent.*" Again, we see that in this project it is more the lack of contractual quality than a lack (or abundance) of contractual specificity that will lead to different perceptions, due to the resulting asymmetry of information and ambiguity with regard to roles and expectations. Additionally, this case provides evidence that specifying contracts does not reduce the need for dialogue about the interpretation of the formal statements.

Project Gamma

Project Gamma concerns the renewal of the superstructure at several locations on a railroad trajectory. It is a smaller and not specifically complex project. Nevertheless, part of this trajectory is a crucial route to a big hub in the Netherlands. Mistakes and malfunctioning would cause much trouble for both principal and agent. The supplier was selected based upon Most Economically Advantageous Tender with criteria on price, past performance, safety and sustainability and the contract was based upon functional specifications.

Mediated power

Within this project, the agent's project manager said that performance reviews that are done by the principal are "*considered in the acquisition* [i.e. as a criterion in the tender] *of new projects.*

So they [i.e. principal] *could take advantage of this but that does not happen here* [i.e. in this project]." So the power that is held by the principal within the project is clearly recognized by the agent. The recognition of this power, and the awareness of its presence also enables the project manager to perceive that this power has not been abused by the principal. As a result, we can see that both parties identify with the end goal, that the collaboration is good and a separation of the roles of principal and agent is hardly present, as is indicated by the project manager of the principal who said that "*We feel and bear the responsibility for the project together. As such, the hierarchical line between principal and agent dissolves.*" Hence, social identification with their own organization becomes less strong due to a responsible handling of power that is hold by the principal. As a result, little perceptual distance is observed in project Gamma.

Contractual specificity

In project Gamma, the agent has to provide plans and descriptions of the processes to the principal. Subsequently, the principal has to accept these documents. The principal's project manager said that "*These plans provide us with trust that* [the project] *takes place safely and within time.*" This is done with the underlying thought that the more is described by the principal "*the more deviations will be found in these descriptions. We specify what we want and in this project we do need to deviate from the normal requirements sometimes.*" From this statement we can conclude that more details in a contract will not lead to a perfect contract but rather to the contrary, which has to do with the uniqueness of every project (Liu et al., 2009). This demands from collaborating partners and their representatives a flexible attitude (Weber & Mayer, 2011). Indeed in project Gamma, a flexible attitude was found at both sides, according to the project manager at the agent: "*We can also make suggestions that deviate from the requirements. Principal is receptive to anything but it needs to be discussed in advance.*"

Furthermore, the project manager at the agent stated that "*the quality of the contract determines how a project goes*" instead of the specificity of a contract. This is confirmed by the project manager at the principal who informed us that, contrary to most projects, in this project after the contracting few changes were requested by the principal, resulting in little effect on project planning and costs. Because the contract was of a higher quality in this project less information asymmetry was found between collaborating partners. As a result, little perceptual distance is observed within project Gamma.

Project Delta

Project Delta concerns the broadening of a station and the trajectory around that station. This includes the sub- and superstructure and overhead wire. This project had a difficult start. It was a large project which meant it was an important project to acquire for many contractors. As such, all contractors submitted bids on the project. Due to some lack of clarity and mistakes in the tender procedure, the supplier selection had to be settled in court. Eventually, the agent was selected and the project could start three months later than initially planned. This resulted in a change order request (COR) as investment was needed to still be able to meet the planning in the original plan. This was a difficult process which affected the relationship between principal and agent. Therefore, at both sides the project managers were changed after the COR was approved. As a result the new managers did not have a bad start in the project, but were able to start off a good collaboration.

Mediated power

Both principal and agent show to have a clear image of the power that is held at either side. The principal states that "*principal owns the money and has the performance review as means of power that can be used, but that should not be abused. At the agent's side it is time pressure,*

but also that has not been abused here." Hence, the principal is not the only power holder in the project and the collaborating partners are dependent upon the behavior of the other party. The agent confirms this statement mentioning that the power that is held by the performance reviews (see also Research context, in Methodology) for instance could be used as a coercive measure by the principal but that has not been done in this project. Furthermore, this project manager adds that "*Project managers at principal are dealing differently with power. In this projects it has not been abused, but that is not the same in every project.*" This indicates that among the different projects that are studied there probably are different ways in which is dealt with the power that is held. Here, the abuse of power is absent, which has resulted in little perceptual distance between the collaborating partners.

Contractual specificity

The project manager in project Delta indicates that it is the agent himself who develops the plans for the project. These plan only have to be approved by the principal. Although the contract had some grey areas according to the project manager at the agent, overall "*the contract was clear and well interpretable and that has affected the results.*" The project manager also spoke in general terms about contracts within the type of projects that are executed for his organization and said that "*A bad contract is a combat contract and that results in worse performance. The biggest risk is that a requirement can be interpreted in multiple ways.*" Still, there were many changes in the project, but these were mostly deemed legitimate and were thus considered to be beyond the original specification that was given by the principal. This means that the agent is compensated for the additional work that needs to be done. This is crucial for contractors as "*margins are small in this industry, and as such the discussions are often with regard to money.*" Overall, the contract was of good quality and therefore well interpretable according to the agent. As a result, less information asymmetry was found in project Delta, leading to similar interpretations of principal and agent. Overall, the interviewees clearly focused on contractual quality instead of contractual specificity as a mitigating factor for perceptual distance in their collaborative project.

Discussion

Overall, from the analysis of the four cases we can derive several insights. First of all, the use of mediated power results in a larger separation and distinction in the roles of principal and agent and thus increases social identification. However, also the acknowledgement of the power bases held at both sides is determining for the level of perceptual distance. Project Bèta showed that where principal and agent are less aware of the power base that both companies have, roles and expectations of both organizations remain ambiguous. In contrast, in project Delta collaborating partners know how the other is capable to assert influence but also what influence they have. As a result, the abuse of power is minimal or absent because the collaborating parties are dependent upon each other, hence their power (Cook, 1977; Cox, 2001), and do not benefit from games of power. Overall, the use of mediated power and a lack of the acknowledgement of power increase social identification and information asymmetry respectively, and thus instigate the determining factors for increased perceptual distance.

The second conclusion based upon the four cases is that contractual specificity in itself is not a denominator of successful projects. Contractual *quality* seems to be what determines whether collaborating partners have similar interpretations of the project. Subsequently, perceptions of how the project goes and how both organizations perform in the project will also be similar (Van der Krift et al., 2018). Concluding, collaborating partners should spend considerable attention to the development of the contract. In this development process, it might be advantageous to have both principal and agent evaluate the quality of the contract as their

perceptions of contractual quality might differ as well. Moreover, both parties eventually determine what needs to be done and how that needs to be done based upon the contract.

This study has several limitations as well. The first and most important limitation is the limited set of cases that were studied. Moreover, the cases have been selected from a single industry, and from two companies within that industry. However, we have been able to distance from company-specific characteristics that affect the dependent variable in these projects by studying different projects within a single collaboration between two organizations. The outcome in this study, perceptual distance, varies over the different projects while the context is largely similar. Hence, we can conclude that project- and collaboration-specific characteristics have influenced perceptual distance and that, as a result, this effect is likely to be found in other collaborations in this industry as well.

In future research, the presumed influence of contractual quality should be further studied. The cases indicated that the quality of the contract has considerable influence on the perceptual distance that is eventually found in a project. Therefore, both practitioners and academics would benefit from further research on this topic, such as a study on how high contract quality can be achieved. Another direction for future research is other bases of power that could have their influence on perceptual distance in projects. In this study we have specifically focused on the mediated power that is applied by the principal. However, the other bases could have influence as well. For example, the perceived level of expert power at either side may very well indicate which of the two parties has most say with regard to what needs to be done. Furthermore, it also indicates how likely the organizations will collaborate in their vision for the project (Maloni & Benton, 2000). Hence, expert power might have a decreasing effect on perceptual distance in projects.

Conclusion

In this study we have investigated the ability of a company to control the alignment of perceptions of principal and agent in complex projects. Two means of control have specifically been studied in four cases in the project industry. These two means are contract-based and power-based control. We have investigated the effects of these means of control on social identification and information asymmetry based upon a cross-case comparison. From these cases we can conclude that mediated power enlarges the distinction between the roles of principal and agent and thus increases social identification. Furthermore, the knowledge and acknowledgement of the power that is held at either side seems to create a situation in which both parties refrain from abuse of this power. Hence, a lack of acknowledgement of power bases increases social identification and information asymmetry in the project as it provides the condition for the abuse of mediated power. As a result perceptual distance between collaborating partners increases. The second means of control, contractual specificity, does not decrease the perceptual distance in the project. Rather, the cases show that it is contractual quality that plays a major role in aligning perceptions of collaborating partners. Therefore, organizations should investigate and acknowledge the power balance in their relationship and should assess the contractual quality from the very beginning of the project in order to align perceptions in their collaborative projects.

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Appendix A. Variables, definition, operational definition and scale items

All items in this questionnaire are answered on a Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Words that are marked with a $ were adjusted to the individual to whom the questionnaire was sent to with regard to his/her company, project, and the principal/agent.

Reference definition or description	Pragmatic, operational description	Scale items (translated from Dutch), reliability and factor loading (in parentheses)	Source
Project objectives		**Project objectives (formative)**	*Van der Krift, Van Weele, & Gevers, 2018*
Satisfaction with the objectives that have to be achieved within the project by the agent and with the financial compensation that is provided for achieving these objectives.	*Goals, objective, aim, expectations, agreements with regard to (a) budget, (b) planning, (c) quality, (d) sustainability, and (e) innovation.*	*We were satisfied with the agreements that we have made with $partner regarding the budget.* *We were satisfied with the agreements that we have made with $partner regarding the planning.* *We were satisfied with the agreements that we have made with $partner regarding the quality standards.* *We were satisfied with the agreements that we have made with $partner regarding sustainability in the project.* *We were satisfied with the agreements that we have made with $partner regarding the innovativity (use of innovative techniques, processes and products) in the project.* *We were satisfied with the agreements that we have made with $partner regarding safety in the project.*	
Decision-making autonomy		**Decision making autonomy (Cronbach's α = 0.811)**	*Aiken & Hage, 1968*
The locus of expertise, responsibility, accountability and authority between principal and agent (Gibson et al, 2009).	*Decision making, autonomy of the agent, freedom of agent in making decisions, authority of the principal.*	*There can be little action taken by $agent until $principal approves a decision.** *If employees at $agent make their own decisions that would be quickly discouraged by $principal.** *Even small matters have to be referred to $principal for a final answer.** *$agent hardly ever has to ask $principal for permission for anything.* *Any decision made by $agent has to have $principal's approval.**	
Competence project manager principal		**Competence project manager principal (Cronbach's α = 0.829)**	*Self-developed for this research in consultation with representative*
The hard skills, i.e. "the depth of knowledge required to cope with a complex task*" and soft*	*Presence of competences in terms of knowledge, expertise, experience,*	*The project manager at $principal…* *has the (technological) expertise that is needed for the project* *manages the project well*	

skills, i.e. ability "to sustain conflicts, to communicate, and to convince*" of the project manager at the principal (Homburg & Jensen, 2007, p. 126).*	*communication, understanding, negotiation, and empathy.*	*makes proper assessments and decisions (for instance at interfaces of disciplines)* *reports and communicates clearly about performance on the project level* *formulates questions/problems clearly* *gets all project members involved*	*of head quarter management of participating company*
Competence project team principal		**Competence project team principal (Cronbach's α = 0.860)**	*Self-developed for this research in consultation with representative of head quarter management of participating company*
*The hard skills, i.e. "*the depth of knowledge required to cope with a complex task*" and soft skills, i.e. ability* "to sustain conflicts, to communicate, and to convince*" of the project team at the principal (Homburg & Jensen, 2007, p. 126).*	*Presence of competences in terms of knowledge, expertise, experience, communication, understanding, negotiation, and empathy.*	*The team members at $principal…* *have the technological expertise that is needed for the project* *work well together in a (multidisciplinary) team* *communicate clearly* *are convincing and assertive* *show great empathic ability* *are good at handling complexity*	
Competence project manager agent		**Competence project manager agent (Cronbach's α = 0.874)**	*Self-developed for this research in consultation with representative of head quarter management of participating company*
*The hard skills, i.e. "*the depth of knowledge required to cope with a complex task*" and soft skills, i.e. ability* "to sustain conflicts, to communicate, and to convince*" of the project manager at the agent (Homburg & Jensen, 2007, p. 126).*	*Presence of competences in terms of knowledge, expertise, experience, communication, understanding, negotiation, and empathy.*	*The project manager at $agent…* *has the (technological) expertise that is needed for the project* *manages the project well* *makes proper assessments and decisions (for instance at interfaces of disciplines)* *reports and communicates clearly about performance on the project level* *understands and complies with the principal's requests* *gets all project members involved*	
Competence project team agent		**Competence project team agent (Cronbach's α = 0.891)**	*Self-developed for this research in consultation with representative of head quarter management of participating company*
*The hard skills, i.e. "*the depth of knowledge required to cope with a complex task*" and soft skills, i.e. ability* "to sustain conflicts, to communicate, and to convince*" of the project team at the agent*	*Presence of competences in terms of knowledge, expertise, experience, communication, understanding, negotiation, and empathy.*	*The team members at $agent…* *have the technological expertise that is needed for the project* *work well together in a (multidisciplinary) team* *communicate clearly* *are convincing and assertive* *make a good translation from the principal's requests to technological solutions*	

(Homburg & Jensen, 2007, p. 126).		*are good at handling complexity*	
Nature of regulations		**Nature of regulations (Cronbach's α = 0.704)**	*Van der Krift et al., 2018*
"The nature of rules that shape economic activity *[…]* how a number of aspects in the buyer-supplier practice are influences by the rule and implementation of legislative institutions *[…]* the stipulation and enforcement of contracts as an important trait of market organization in business-to-business settings*." (Andersen et al., 2009, p. 815).*	*Importance and type of the contract and formal agreements. Use of contract and clauses during project execution.*	*The contractual agreements are important to $self.* *Within $self we attach little value to the contract as a tool within the collaboration.** *The contract is essential to the collaboration to maintain sufficient control over the execution (omitted).* *Within $self people point out to others anything in the project that does not pass off in accordance with the contract.* *It is important within $self to regularly bring out the contract in order to check all project matters.*	
Trustworthiness		**Trustworthiness (Cronbach's α = 0.769)**	*Van der Krift et al., 2018*
"The degree to which there is a correspondence between the stated rules and their implementation." *(Andersen et al., 2009, p. 815).* "The degree to which partners expect to be able to rely on each others' words and promises as a sufficient guarantee for establishing agreements on which they can plan future events." *(Andersen et al., 2009, p. 817).*	*Extent to which parties stand by agreements and stick to their promises, consistency in actions, and trustworthiness.*	*They ($partner) always stick to the agreements that we have made on paper.* *$partner properly establishes oral agreements regarding changes in the contract.* *Regularly, $partner tries to circumvent contractual agreements.*.* *The execution corresponds to what has been contractually agreed upon.* *We are satisfied with the type of contract that has been concluded.*	
Flexibility		**Flexibility (Cronbach's α = 0.852)**	*Stephen & Coote, 2007*
"Flexibility defines a bilateral expectation of willingness to make adaptations as circumstances change." *(Heide & John, 1992, p. 35).*	*Flexibility, open dealing with (requests to) changes.*	*In this collaboration, we are able to make adjustments in our relationship without significant disputes, conflicts, or uncooperative behaviors.* *When unexpected situations arose, we preferred to work out a new arrangement rather than holding each other to the original arrangement (omitted).*	

		When unexpected events occurred, both parties were open to modifying previous agreements. *$partner and $self are flexible in response to requests made by each other throughout the course of the project.*	
Information exchange		**Information exchange (Cronbach's α = 0.841)**	*Stephen & Coote, 2007*
"Information exchange is the expectation that the parties will freely and actively provide useful information to each other." (Heide & John, 1992, p. 35).	*Information exchange, communication, openness, sharing or withholding of knowledge.*	*Both parties are willing to provide proprietary information if it helps each other.* *Both parties keep each other informed about any events or changes that may affected either party.* *Information that was relevant to the project was exchanged willingly.* *Each party provided proprietary information that was helpful to the other (omitted).*	
Organizational responsiveness agent		**Organizational responsiveness agent (Cronbach's α = 0.806)**	*Lavie et al., 2012; Van der Krift et al., 2018*
"A firm's reactive to external entities and events occurring in its environment […] willingness to be open-minded […] responses to emerging industry opportunities." (Lavie et al., 2012, p. 1457).	*Level of creativity and open problem solving in and adaptability of the agent's organization.*	*$agent has an open attitude towards $principal in case of problem solving.* *At $agent they are open minded and creative in their approach to problem solving.* *$agent responds quickly to emerging situations, changes, and chances.*	
Internal task routines agent		**Internal task routines agent (Cronbach's α = 0.831)**	*Lavie et al., 2012; Pothukuchi et al., 2002; Van der Krift et al., 2018*
"[How] employees perform ordinary tasks *[manifested in]* the discretion that employees apply *[…]* the effort they exert when developing, attaining and master organizational skills*" (Lavie et al., 2012, p. 1458).*	*Efficiency of routines and process-based working. Speed and initiative in working ethics.*	*$agent has goal focused and achievement oriented employees.* *$agent has employees with a strong work ethic (defy the 9-to-5 attitude, willing to do whatever it takes to get the job done).* *Within $agent employees are encouraged to make decisions themselves.* *Within $agent teamwork and cooperation (e.g., collaboration among individuals from different business units) is emphasized.* *Employees of $agent are fast at work.* *Employees of $agent take initiative.*	
Management style		**Management style (Cronbach's α = 0.713)**	*Lavie et al., 2012; Van der Krift et al., 2018*
"A firm's management style is defined by its unique managerial approach, control systems, decision-making	*Level of bureaucracy and hierarchy, process of decision-making, and authority that project*	*$self is an informal organization (has few managerial layers, loose control and monitoring; few bureaucratic procedures and contracts).* *Decision making within $self is based upon consensus (of many people) rather than upon authoritarian decision making (by a senior person) (omitted).*	

style, and communication modes *[…]* reliance on hierarchy, formal rule systems and strict controls.*" (Lavie et al., 2012, p.1456).*	*members have in respective organizations (their back-office).*	*Within $self informal communication is preferred over formal communication (short presentations and no lengthy written reports).* *Within $self decisions are guided by concrete considerations and planned processes rather than by hidden agendas.*

* *Items marked with an asterisk are reversed in the scale*

Sustainable public procurement: legitimacy and legality versus appropriateness and efficiency

Marc van Pelt[a]

Cees J. Gelderman[b]

Janjaap Semeijn[c]

[a] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762590, e-mail vanpelt15@hotmail.com

[b] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762590, e-mail kees.gelderman@ou.nl

[c] Open University of the Netherlands, Faculty of Management, Science and Technology, PO Box 2960, 6401 DL Heerlen, The Netherlands, telephone +31455762588, e-mail: janjaap.semeijn@ou.nl

Abstract

Many public organizations, including municipalities, feel the need to proceed with the development of sustainable public procurement. Municipalities have shown a general tendency to buy in a sustainable manner, with mixed results in speed and real adoption of sustainable public procurement. Many studies have focused on internal drivers and barriers within public agencies, while less attention has been given to the impact of external actors and factors. Based on 34 interviews, we investigate ten different procurement projects in three mid-sized Dutch municipalities. As expected, the national government tries to force local governments to include sustainability criteria in public tenders. Although legal enforcement is generally believed to have a significant impact we observed a lack of legal pressure to enforce sustainable buying. Real pressure appears to stem from lobbying by sector organizations, individual companies, and citizens. Concerned citizens are frequently consulted in city planning and increasingly participate in reaching local goals, such as "a climate neutral city". Remarkably, the hybrid structure of the procurement function is an unexpected barrier: the central procurement function adds sustainability only to large public tenders. For the remaining two-thirds of public spend, only limited tendering procedures are used by decentralized procurement professionals, lacking time and knowledge to structurally include sustainability criteria. With some exceptions, we conclude that legitimacy and legality still prevail over appropriateness and efficiency in achieving sustainability by public procurement.

Keywords: public procurement, sustainability, external pressures, stakeholder theory, case study

Category: competitive paper (IPSERA 2018)

1 Introduction

Governments are putting pressure on business to make a shift to a more sustainable strategy. The national government is both forcing ('MJA agreements') and supporting ('Green Deals', 'PIANOo guidelines') a sustainable business strategy. The supply chain, with the procurement functionality as a significant part, can actively support and reinforce sustainability (e.g. Carter & Rogers, 2008; Wolf, 2014). Public procurement can make an effective contribution to the targets of the Paris agreement and consequently change supply chains (Bratt et al., 2013; Grandia et al., 2015).

In spite of reinforcement and support from Government and procurement institutions, several studies indicate differences in speed of the roadmap towards a more sustainable attitude and compliant actions within governmental bodies, i.e. municipalities (Ecorys, 213; Zoeteman et al., 2016). Various studies distinguish drivers and barriers that have impact on the level of sustainability in procurement (e.g. Ageron et al., 2011; Bos-Brouwers et al., 2010; Brammer & Walker, 2009, 2011; Carter & Rogers, 2008; Günther & Scheibe, 2006; Michelsen & De Boer, 2009; Preuss, 2009).

With respect to drivers and barriers on sustainable procurement in the public sector, results point at the omission of targets within the organization, lack of procurement professionalism and up-to-date knowledge, primarily internal factors (e.g. Brammer & Walker, 2011; Gelderman et al., 2015; Günther et al., 2013). Only a few of these drivers and barriers relate to external actors and factors that influence sustainable public procurement. There are signs that clear legislation is missing (Giunipero et al., 2012; Igarashi et al., 2015) as well as action-oriented attention from national and local politicians. Thai (2001) presents a roughly defined public procurement model with four external pressures: legal, political, market and social-economic. Up to now however, there has not been a more comprehensive investigation into the influence from external actors and factors on the development of sustainable public procurement. This study has a clear focus on collecting the external actors and factors with respect to (sustainable) public procurement and their influence on its development.

We executed a multiple case study among three mid-sized municipalities in the Netherlands in order to investigate external actors and factors, and their impact on sustainable public procurement. Through 34 in-depth interviews and document analysis we classified these actors and factors in five categories: legal, political, market and social/economic pressure (cf. Thai, 2001) and we added a fifth category, i.e. societal pressure.

2 Literature review

2.1 Public procurement

Procurement in general has made great progress in the last twenty years from a static, isolated and cost-oriented role into a dynamic and strategic function within the supply chain (Meehan & Bryde, 2011; Thai, 2001). A sustainable approach of markets results into a sustainable supply chain (Krause et al, 2009), in which the public procurement function (Thai, 2001) aims for sustainability through the Triple Bottom Line approach, the balance between economical, ecological and social aspects when purchasing goods and services.

Public procurement, however, has specific additional requirements (Telgen et al., 2012; Thai, 2001) as a result of a variety of stakeholders and their sometimes conflicting and opposing interests (e.g. McCue et al., 2015; Uyarra & Flanagan, 2010). Requirements include important aspects as accountability, responsiveness and transparency which refer to integrity and exemplary behaviour. These additional requirements influence internal procedures and processes, i.e. EU legislation, and national governmental procurement laws and governmental guidelines for sustainable procurement.

2.2 Sustainable public procurement

In sustainable public procurement, the Triple Bottom Line approach (Brammer & Walker, 2011; Elkington, 1997; Meehan & Bryde, 2011) is used to realize a balance in goal setting between economical, ecological en social aspects of the goods and services purchased. This starting point of sustainability adds to the widespread definition of the WECD (1987): ”utilizing resources to meet the needs of the present without compromising the ability of future generations to meet their own needs”. The public sector acknowledges its crucial role in making a high amount of supply chains more sustainable, by increased pressure from their significant purchasing spend, approximately 16% of the total purchasing spend of any EU country. As a result, the public sector is able to realize public oriented objectives such as social equity, economical development and ecological advantages (Nijaki & Worrel, 2012).

Public agencies should contribute to a sustainable society (Preuss, 2009; Testa et al., 2012). In daily practice, achieving these more strategic goals is difficult (Gelderman et al., 2015; Meehan & Bryde, 2011). One aspect is the limited knowledge and available data of the real footprint of products and services that goes beyond its ecological footprint (Tate et al., 2012). The size of an organization also matters: the bigger the organization, the more power on implementing sustainable pubic procurement in practice (Michelsen & De Boer, 2009). Also of great importance is the internal discussion between purchaser, deputy manager and city council on the cost allocation of a more sustainable procurement policy, which also refer to the need for efficient spend of tax payer’s money (Gelderman et al., 2015; Telgen et al., 2012).

One way to put force on sustainable supply chains is by adopting more sustainable selection criteria in EU tenders (Testa et al., 2012; Testa et al., 2016). Support comes from the EU Buying Green Handbook 2016, the 2012 Procurement Law in the Netherlands (effected in 2016) and sustainable guidelines from the government (PIAONOo) for many product categories (www.pianoo.nl). However, these criteria lack a legal status and as a result remain non-committal. Nevertheless, more and more municipalities use a strategic approach to make their procurement activities more sustainable (Bratt et al., 2013), by preferably buying local and as sustainable as possible, despite all difficulties in legislation, government criteria and a complex stakeholder management (Thomson & Jackson, 2007). Walker & Brammer (2009) conclude that successful sustainable procurement should keep four factors in mind, i.e. ‘good knowledge of legislation’, ‘perceived inefficiency and legal costs’, ‘cooperation with suppliers’ and ‘internal incentives and pressure’.

2.3 Actors and factors

Despite all available tools and good initiatives, there is no consistent positive view on the results of sustainable public procurement (e.g. De Boer, 2013; Zoeteman et al., 2016).

Reasons could be the missing ambition (Crespin-Mazet et al., 2012), the limitation to minimum green requirements in tenders (Melissen & Reinders, 2012), the lack of maturity in strategy and execution (Grandia & Meehan, 2017) and/or the perceived additional costs of sustainability (Bratt et al., 2013).

a. Relation stakeholder theory and sustainable procurement

The public sector in general and public procurement in particular have to deal with a variety of objectives, requirements and stakeholders. Stakeholder approach largely received attention after Freemans (1984) published the book "Strategic Management, a stakeholder approach" Mitchell et al. (1997) define three aspects that qualify the required attention (called 'salience') for any stakeholder: 'power', 'legitimacy' and 'urgency'. Identifying and classifying stakeholders in any of these aspects result in a typology of stakeholders prioritizing the attention to be given to a specific stakeholder ('salience').

Neville et al. (2011) point at the 'continuum of these aspects', not by being present or absent or excluding each other but in relation and interaction of the aspects. In contrast to salience from the typology only, managers should pay attention to all stakeholders, regardless of the typology and this also refers to the moral aspect of stakeholders' claims (Neville et al., 2011). In particular, public agencies, as external oriented organizations, have to deal with these moral aspects in relation to the interests of the variety of stakeholders. Stakeholders can be classified by 'extent of interest' and 'extent of power'(e.g. Johnson et al., 2005; Williams & Lewis, 2008).

Increasingly, the private sector experiences pressure from stakeholders (customers, suppliers, interest groups, NGOs and public authorities). Public agencies are faced with the risks of reputation (Carter & Jennings, 2004). Various studies conclude that stakeholders can be characterized as driver as well as barrier for an organization's sustainability (e.g. Bos-Brouwers et al., 2010; Giunipero et al., 2012; Walker et al., 2008). A multiple stakeholder approach influences the reputation of private and public organizations (Williams & Lewis, 2008) and contributes to a modern government (Foo et al., 2011). Government must balance between different interests which affects its policies, its sustainable objectives and, as a consequence, the public procurement strategy. Stakeholders with different views influence defining and adjusting sustainable procurement strategies and require salience (Mitchell, 1997; Williams & Lewis, 2008). Stakeholder management is a must for public institutions.

b. Internal actors and factors

The extent to which public procurement is moving towards a sustainable direction depends on several actors and factors. Drivers and barriers for sustainable public procurement can be found in several research papers (e.g. Amann et al., 2014; Bos-Brouwers et al., 2010; Brammer & Walker, 2011; Gelderman et al., 2017; Meehan & Bryde, 2011; Giunipero et al., 2012; Walker et al., 2008). Important internal factors include institutional tardiness, aiming for stability, resistance to change and desired predictability. For the implementation of new (sustainable) procurement practices, interaction between administration (e.g. city council) and purchasing department is needed. Sustainable procurement procedures require adaptation by purchasing employees and executive managers, but must also be supported by the (elected) board of the public institutions such as the parliament and the local councils. Public employees are asked to adapt new procedures and to change behaviour in personal commitment (Grandia, 2016; Thomson & Jackson, 2007; Walker et al., 2008) and incorporating sustainable criteria in public tenders (Testa et al., 2012).

Several publications emphasize the importance of knowledge and skills for effective implementation of sustainable public procurement (Brammer & Walker, 2010; Meehan & Bryde, 2011; Testa et al., 2012; Walker & Brammer, 2009). The overall conclusion is that best results stem from personal commitment and willingness to change, complemented by tools for evaluation and market research (Gunther & Scheibe, 2006; Walker & Brammer, 2008). However, a major barrier remains the perceived additional costs of sustainable procurement (Bratt et al., 2013) as well as lack of time (Bos-Brouwers et al., 2010). Balancing possible conflicting goals not only affect social, economic and ecological aspects but are also of great concern to the administrative top management such as city councils and government officials (Gelderman et al., 2015; Meehan & Bryde, 2011). Government (top) management and officials play a crucial role in achieving the best results in sustainable procurement.

c. External actors and factors

Several publications state that external actors and factors may be of more influence on the extent of sustainable public procurement (Crespin-Mazet et al, 2012; Walker et al., 2008) than internal forces. These publicatioins stress the importance of cooperation within the supply chain and with non-business actors (NGOs, labelling organizations). There is continuous interaction between external and internal actors and factors with impact on the process of implementing sustainable public procurement (Gelderman et al., 2017).

The public sector itself influences and is influenced by the external environment, which put pressure on policies. This external environment may have conflicting goals (Nijaki & Worrel, 2012, Uyarra & Flanagan, 2010) and is part of the Public Procurement System (Thai, 2001). This system includes legal forces, political forces, market forces and social, economic and other forces. We have added a fifth component ‘societal forces’ that include actions from citizens, both individually and as a group.

- Legal forces

As a result of the civil servant’s nature to comply to rules and regulations (Grandia et al., 2015), legislation is a very important external factor. Apart from international procurement standards (GPA) and EU procurement legislation, the Netherlands introduced a revised national procurement law (Aanbestedingswet 2012, AW2012). To support public institutions in buying green, the government issued sustainable guidelines (PIANOo) individual product categories in order to positively influence sustainable buying behaviour. Familiarity with legislation and supporting tools will encourage purchasers to comply to sustainable standards. The AW2012 supports buying on other aspects than lowest price (EMVI doctrine on selecting the best economic offer), but is not compulsory in the procurement process, which makes it non-binding/non-committal to the purchasing professionals.

Actors/factors in this study: RVO (PIANOo organization and guidelines), AW2012, best practices, (inter)national pressure, ambition

- Political forces

Political pressure has both internal and external aspects and has a relation with the principal-agent theory (Gelderman et al., 2015): political parties (‘principal’, external actor) are represented in administrations by e.g. majors and city councils (‘agent’, internal actor). The installation of city coucils is every four years after election. called ’the election cycle’ (Walker & Brammer, 2010). As actors, the city council (politician, external) and the civil servant (purchaser, internal) may have conflicting interests (Gelderman et al., 2015).

Actors/factors in this study: political parties, city councils, administration structure and agreements, ambition, governmental bodies.

- Market forces

In the supply chain, organizations are confronted ‘upstream’ with stakeholders such as the general public and customers. On the other side, purchasers have to deal with pressure from ‘downstream’ in the trade-off between sustainability and costs during the process of selecting suppliers, which aspects may be adversely (Reuter et al., 2012). From this perspective, the private sector takes more of a leading role in sustainable management than the public sector (De Boer, 2013) and sustainability is regarded as an important factor in new business models. From this point of view, public authorities support private sector sustainable ambitions by introducing so called ‘Green Deals’, to overcome legal and financial barriers.

Actors/factors in this study: companies, sector organizations, unions, Green Deals, disputes.

- Social and economic forces

The public sector feels pressure from actors of social and economic origin, who try to influence public procurement from their specific interests. Regularly, commercial interests may be the driving force, such as labelling organizations. These bodies introduce specific standards, start advising on these standards, and are controlling the market. If incorporated in tenders, labels and standards are of specific importance to realize sustainable procurement; they come third after aspects price and quality (Igarashi et al., 2015).

Crespin-Mazet et al. (2012) named these organizations ‘non-business actors’, stakeholders not related to the business. NGOs are developing themselves into the direction of cooperation instead of steering conflicts in order to realize their goals. Several studies point at the positive effects of non-business actors on achieving sustainability (e.g. Crespin-Mazet et al., 2012; Günther & Scheibe, 2006; Melissen & Reinders, 2012; Preuss, 2009; Thomson & Jackson, 2007; Walker & Brammer, 2009). Bügl et al. (2011) emphasize the possibility of conflicting interests between non-business actors and the challenges of the public sector authorities in managing these issues. Within the public sector agencies do cooperate, but may also have conflicting interests (Hoejmose & Adrien-Kirby, 2012).

Actors/factors in this study: NGOs (Greenpeace, Nature & Environment), research institutes (NEVI, SKAO, NEN), best practices, rankings of public organizations.

- Societal forces

We added a fifth element to the Public Procurement System (Thai, 2001, p. 33) by introducing ‘societal forces’. In the last decade markets and governments were forced into increased transparency. Due to technological developments, e.g. big data, internet, all organizations are influenced by the forced transparency coming from these developments (Telgen et al., 2012). Also within external forces (such as from citizens) there are modern options to stay in touch (email, WhatsApp, Facebook) and to cooperate in grass root initiatives. Results from recent research indicate that EU citizens expect their public authorities to evaluate other aspects besides the cost (quality, sustainability) in public procurement (Keulemans & Van der Walle, 2017).

The impact of societal forces has not been investigated extensively. Obviously, municipalities have an external orientation on citizens and local society. We investigated if the society develops a force towards their public authorities, comparable with societal force towards

sustainable procurement in the private sector (Foo et al., 2011; Wolf, 2014). Specifically, we looked at communities, local media and media attention, public participation, civil protests and disputes

We explored the external forces from five angles and their impact on the extent of sustainable public procurement. We include interactions between as well as within the external actors and factors and the consequences of that interaction on the development of sustainable public procurement.

2.4 Theoretical background

The problem statement of this study focuses on investigating the impact of external actors and external factors on the development of sustainable public procurement. From a theoretical point of view, our problem statement is related to several theories. The stakeholder theory (Freeman, 19084; Mitchell et al., 1997; Neville et al., 2011) describes the attention given to and the acknowledgement of a stakeholder ('salience'). Besides, the principal-agent theory has impact on the development of sustainable public procurement by pointing out the possible different opinions and strategies of the alderman (agent) and the principal (city council members from a political party). Finally, several publications point out that the public sector should contribute to a sustainable society (Preuss, 2009; Testa et al., 2012) and, in doing so, must take into account additional purchasing requirements (Telgen et al., 2012; Thai, 2001).

3 Research method

The design of our qualitative, exploratory study is aimed at investigating "a contemporary phenomenon in depth and within its real life context" (cf. Yin, 2014, p. 4). Three mid-sized municipalities in the Netherlands were included in our multiple case study. The selection of municipalities was based on location (spread among the country) and size (between 150,000 to 200,000 citizens). We have selected mid-sized municipalities because of their interesting position between the small municipality with little attention for sustainable procurement and the large municipalities with compliancy to sustainable objectives (Zoeteman et al., 2016). Data collection was focused on the inventory of external actors and factors in accordance with the four categories of Thai (2001).

We investigated the external forces and examined their impact on the development of sustainable public procurement by document analysis and interviews. We executed a document analysis from three different angles. First, we examined the procurement strategies of the cases organizations and investigated sustainable aspects. Second, we analyzed 10 procurement projects from all three case organizations, in which external force was perceived by the respondents as they have mentioned in the interviews (see Table 1). Finally, we looked into the various correspondence regarding sustainable elements in procurement perspective within the case organizations.

The in-depth semi- structured interviews were held with respondents inside and outside the municipalities, adding up to a total number of 34 interviews. The key players within the case organization were all functionally involved in procurement processes. Respondents held the following job titles: CEO, CFO, procurement manager, procurement advisor, facility manager, purchaser and sustainability officer. We also interviewed the aldermen of the three

municipalities as well as various members of their city council. From these interviews, we took notice of all external actors to which respondents refer to and held our interviews with those external actors as well. Key respondents from outside the municipalities were employed by or associated with the Ministry of Economic Affairs, Ngo's, political parties, entrepreneur and trade associations, branch organizations, knowledge institutes, and citizen pressure groups. All interviews were guided by an interview protocol which was based on the results of the literature review. The use of semi-structured interviews gave us the necessary flexibility and allowed us to zoom in on external actors and factors that potentially impacted the development of sustainable development of procurement. This approach also provided the possibility to identify other factors that were not found in literature, which is in line with the descriptive and explorative nature of our study.

Table 1 Investigated procurement projects

Municipality 1	Municipality 2	Municipality 3
Fleet of vehicles (2015)	Fleet of vehicles (2015)	Machines for hot beverages (2014)
Machines for hot beverages (2015)	Energy (2016)	Catering (2014)
Food/non-food (2014)	Digitization construction archives (2016)	Transport in the context of the Social Support Act (2016)
	Cleaning (2017)	

In addition to the interviews within the case organizations we investigated the five external forces with an impact on the development of sustainable public procurement. Moreover, we deepened our knowledge of interactions *between* external actors and factors but also *within* external actors and factors. The leading question is: if interaction takes place, in what way and in what direction does cooperation exists between parties with the aim to influence sustainable aspects of public procurement?

4 Results

4.1 Organization and development of sustainable procurement

The three case organizations are mid-sized and have a comparable organizational structure. Due to the economic recession between 2008 and 2014, municipalities suffered from cost savings and budget cuts. As a result, the number of sustainability functions (officials) was minimized or completely liquidated. This had a huge impact on focus on the subject and, as a result, the development of sustainable procurement within the public sector. In all three case organizations the need for a sustainable municipality is translated into the ambition of becoming climate neutral in the future. The speed to achieve a climate neutral municipality varies from years 2025 to 2050. Everyone expects the procurement function to contribute to this climate neutral objective. Although sustainable procurement is incorporated in purchasing policy, the level of sustainable procurement still lags behind. We found that accountants check for legitimacy of the process, and that the finance department monitors spending, while the effectiveness of sustainable procurement seems neglected. Apparently, with some

exceptions, legitimacy and legality still prevail over appropriateness and efficiency in achieving sustainability in municipalities.

The cause of this deficiency stems from the hybrid structure of the procurement function and its impact on the development of sustainable procurement. Each case organization strictly monitors of European tenders (1/3 of spend) and these tenders are subject to sustainability requirements. However, the remaining 2/3 of spend comes from purchasing projects within decentralized expert groups, and therefore stay 'under the radar' with a lack of monitoring of sustainable requirements. Our research shows that, in general, the large tenders (1/3 of the spend) are controlled by the staff function and, as a result, are more committed to sustainable procurement. Apparently, municipalities achieve less sustainability results by limited tendering for their smaller purchases (see Table 2).

The organizational position of the procurement function has a significant impact on the sustainable development of municipalities. Procurement as a function in mid-sized municipalities operates at two levels. The purchasing function is spread over expert groups for specific and specialized product categories and, at the same time, as a staff function with internal consultants for the procurement strategy and advisory on large purchasing projects (European tenders). As a staff member stated: "We only consider the larger tender projects. There is no time for the smaller ones." This lack of attention also refers to the accountants' control on purchasing projects: "We only assess on financial issues in individual purchasing projects."

As a result of the hybrid organizational structure, external pressure on public procurement may enter at two functional levels within the organization: the purchaser in a decentralized expert group and/or the procurement consultant in the central staff. The political function within the municipalities also operates at two levels: the alderman is part of the local government (internal actor) but at the same time is attached to his or her political party (external actor), who supervises the local government by the elected city councils.

Another factor of influence proved to be the targeting of operational goals and activities of municipalities. Mayor and aldermen hold the governance functions and agree on ambitions and policies in a so called 'governance agreement' for a four years period. From these ambitions and policies, administrative top management defines the distracted goals into the operational functional areas. Clearly, there are tensions between party-political aldermen, procurement professionals and department managers.

Table 2 Sustainable procurement in the investigated municipalities

Issue	*Municipality 1*	*Municipality 2*	*Municipality 3*
Structure of the procurement function	Hybrid: process control and advice are centralized; operational procurement is decentralized.	Hybrid: process control and advice are centralized; operational procurement is decentralized.	Hybrid: process control and advice are centralized; operational procurement is decentralized.
Development of sustainable procurement	Procurement strategy contributes to a climate neutral city.	Sustainable procurement plays an exemplary role. Goal is the optimum in	Sustainability is key. Goals of a climate neutral city is

		the triple bottom line.	translated into sustainable chain oriented purchasing.
Tendering procedures	Sustainability criteria for large public tenders (1/3 of total spend); less sustainability and limited tendering for smaller purchases (remaining 2/3).	Limited tendering is used for a large part of the total spend. Inclusion of sustainability criteria depends on decentralized operational procurement.	Sustainability criteria for large public tenders (1/3 of total spend); less sustainability and limited tendering for smaller purchases (remaining 2/3).
Monitoring and control	The accountants check for legitimacy, the finance department monitors spending.	A feeling of non-commitment stems from the lack of control by the legislature.	Internal accountants monitor the legitimacy of procurement projects.

4.2 External pressures on sustainable procurement

In all three case organizations, interviews with key players and document analysis have resulted in a cross case analysis with insights into the influence of the five external factors on the development of sustainable procurement, see Table 3.

- Legal forces

Legislation and the PIANOo guidelines are at the base of (sustainable) procurement in all of the three municipalities. However, these guidelines and principles are considered non-binding due to a lack of penalties in case of non-compliance and an internal focus on legitimacy and financial aspects. According to an alderman: "The lack of monitoring and control is a barrier for the development of sustainable procurement." Apparently, legitimacy and legality prevail over appropriateness and efficiency in achieving sustainable procurement.

- Political forces

The generic sustainability policy is developed by the municipal council of (party-political) aldermen who have signed a management agreement for a period of four years. The members of the city council are not involved in defining the sustainable procurement strategy nor in the execution and implementation in separate procurement initiatives and projects, such as tenders . Members of the city council merely perform controlling tasks, feeling that they "assume that the four years management agreement is executed in a proper way".

Table 3 External forces on sustainable procurement

Issue	*Municipality 1*	*Municipality 2*	*Municipality 3*
Legal forces	Use of sustainability guidelines (PIANOo). However, no legal enforcement due to a lack of penalties.	Compliance with laws and regulations, adaptation legal sustainable requirements in entire organization	Handling legislation and PIANOo guidelines; EMVI and convenants are non-binding and may restrict the desired extra steps
Political forces	Aldermen define the reach of city's ambition in the governance agreement; city council takes action if there	City council trust aldermen to execute procurement policies according to the governance agreement and	The political orientation of the alderman and the city council strongly impact sustainability goals.

	are (negative) external signals.	reacts to external signals.	Development and execution of policies are strictly separated.
Market forces	Branch organizations and companies monitor tenders and sometimes request other specifications. No pressure is felt if the legal obligations are met.	A local business collective runs a 'soft lobby' which results in more attention for the local economy.	Branch organization's lobbies have influence; market consulting enhances influence but reduces the pressure on sustainability.
Social and economic forces	The rankings published by NGOs raise issues in local media and meetings of the city council.	NGO reports raise questions that are discussed in meetings of the city council. However, policies are not adjusted as long as legal obligations are met.	Subject oriented NGOs are very active, they are invited for consultation by the local government. Most commonly consensus is achieved.
Societal forces	Citizens are being consulted on sustainability issues. Local initiatives are welcomed.	Local interest groups exert pressure on sustainability. There is pressure on sustainability in general, not on sustainable procurement in particular.	Neighborhood councils are actively involved in sustainable initiatives. There is pressure on sustainability in general, not on sustainable procurement in particular.
Most powerful external force	Most pressure from legislation and PIANOo guidelines, as well as the political orientation of the aldermen and city council.	Most pressure from legislation and PIANOo guidelines. Focus on local economy. Influence from local interest groups.	Most pressure from legislation and PIANOo guidelines, as well as the political orientation of the aldermen and city council.

- Market forces

Municipalities only meet with market pressure if tenders are not executed according to legislation and accepted guidelines. Whenever called for, the legal affairs department will be involved in particular cases. Branch organizations, for instance for building construction and waterworks, monitor public tenders and incidentally request other specifications (municipality 1 and 3). In municipality 2, a local business collective runs a rather soft but successful lobby for contracting local suppliers and stimulating the local economy. Actually, companies "have no means of pressure if municipalities can prove that they executed the purchasing process according to the Procurement Law 2012". This law does not enforce sustainable procurement; moreover, the PIANOo guidelines are non-committal.

- Social and economic forces

In all of the three municipalities, NGO reports that include the ranking of municipalities on sustainability, raise questions and issues that are discussed in meetings with aldermen and the city council: "a bad position in rankings always lead to critical remarks and questions from city council members". One of the interviewed alderman also pointed at the lack of pressure because: "Various researchers have different opinions on sustainable subjects". Such an observation offers a way out in delicate discussions. Again, no pressure is felt, if the legal obligations of the tender are met. The importance of certificates, hallmarks and quality labels are recognized. Corresponding requirements are most commonly included in the list of requirements (municipality 1 and 2). Despite of pressure from labor unions and local media, purchasing policies are never adjusted (municipality 2). Remarkably, trade unions only incidentally raise questions on the social part of the Triple bottom Line approach and are,

according to a city council member “completely lacking in discussions on sustainable procurement”.

- Societal forces
Generally, municipalities value open communication with their citizens. Local initiatives are welcomed and citizens are consulted about (local) sustainability issues (municipality 1 and 2). However, there is societal pressure on sustainability in general, but not on sustainable procurement in particular: “the procurement projects of the municipality as such is not a very sexy subject and does not interfere in any way with the regular interests from citizens”. On the other hand, the theme of sustainability is important for citizens, although sustainable procurement lies outside the area of interest of citizens.

The most powerful external force in stimulating sustainable procurement within the three case organizations appears to be the Central Government with its ‘Procurement Law’ and PIANOo guidelines. In fact, both national and local politics have the power to effectively realize a sustainable procurement strategy and implementation.

5 Discussion

Measuring the development of sustainable public procurement is not easy and therefore multiple studies report positive trends towards sustainable procurement but with different outcomes (De Boer, 2013; Zoeteman et al., 2016). The results of this study reveal that the cause of these differences may be due to the lack of monitoring the smaller, non-European tenders, which amount up to 2/3 of the total purchase spend. The new MVI covenant from the national Government for sustainable procurement will stimulate data collection and analysis, but is adopted by merely 80 (out of 388) municipalities.

There are internal and external influences on sustainable procurement. Internally, success of sustainable procurement depends on the tension between decision makers: alderman, purchaser and budget owner. The latter proves to be of crucial importance (Gelderman et al., 2015). It is obvious that public organizations acknowledge their responsibilities and agree various sustainable policies, among them the procurement function with the incorporation of sustainable criteria (Testa et al., 2012). The Triple Bottom Line approach (Brammer & Walker, 2011; Elkington, 1997; Meehan & Bryde, 2011) is well accepted as a starting point for sustainable procurement by the public sector, but the sector is also in need of up-to-date rules and regulations by the government. In short: ‘sustainability is here to stay’ and top priority for cities, citizens and companies.

The assumption that municipalities have adopted sustainability in their procurement policies and ensure this on strategic level is correct. However, there should be more focus on implementation of this strategy at a decentralized level. Moreover, monitoring of results is essential for a contribution to the objective of a ‘climate neutral city’. Citizens expect their local government to adopt green purchasing (Keulemans & Van der Walle, 2017). Nevertheless, there is unanimous commitment to sustainable procurement but still a way to go to change ‘default behaviour’.

The reviewing of external actors on the level of sustainable procurement suggests that the widely perceived societal pressure on private companies (cf. Wolf, 2014) is non-existing in the public sector, due to a lack of interest for local administration and procurement. However, citizens do acknowledge the importance of sustainable procurement (Keulemans & Van der

Walle, 2017). Authorities have tried to overcome this problem by involving local communities in the local decisions to be made and, to create legitimacy for the priorities within the municipality.

Within the five investigated external forces, most pressure comes from legal and political pressure. This observation refers more to the legality of the procurement process rather than the functionality of goods and services to be purchased. The national government sets standards (AW2012, Dutch Procurement Law) offers guidelines and suggests a more sustainable way of purchasing. Despite of good intentions, these initiatives are non-binding and as the CEO of one case organization states: "our city reports sustainability results on a very regular base to central government, but we are never getting any feedback". Politicians (aldermen, city council members, national political parties) can effectively stimulate and force new legislation and can make up-to-date sustainable guidelines applicable and binding. This will significantly support the internal administrative organization in sustainable objectives and puts pressure on changing default behavior within the internal organization (Grandia et al., 2015; Grandia, 2016; Thomson & Jackson, 2007; Walker et al., 2008).

The private sector seems ready for this new approach and takes steps to develop opportunities in sustainable products and services that may result in a competitive advantage over competition. Sustainable criteria in public tenders do not experience resistance from market parties, who in fact point out that public organizations do not fully benefit from all new (sustainable) technologies. Innovation and co-creation may, however, be difficult from a legal point of view, but definitely supports sustainable public procurement (Crespin-Mazet et al, 2012; Walker et al., 2008).

Reports from NGOs put pressure on the private sector and force markets and supply chains to reconsider their (production) strategies. In public organizations, those reports have a delayed effect: a poor ranking for the municipality means attention from local politicians as well as rethinking selection criteria for future tenders.

6 Conclusions and recommendations

Most studies on the development of sustainable public procurement have focused on internal drivers and barriers. This multiple case study has examined the influence of five external forces, i.e. 'legal forces', 'political forces', market forces', 'social and economic forces' and 'societal forces'. Based on 34 interviews, we have investigated ten sustainable procurement projects in three Dutch municipalities.

In general, there has been a positive development of sustainable procurement within municipalities, in policy and strategy as well as in implementation. However, the hybrid structure of the procurement function may be a barrier: procurement advisors on central level are watching over legality of the purchasing process and are adding sustainable aspects in the large public tenders (1/3 of the procurement spend). The remaining 2/3 procurement spend receive less attention from the central advisory department and, as a result, purchasers are independent in making their own decisions on purchasing issues. Sustainability receives attention but the real effects are not easy to monitor. Decentralized purchasers lack time and money to fully focus on sustainable procurement criteria. A sound and reliable conclusion on the level of sustainable procurement within municipalities can therefore not be drawn. Moreover, managing the sustainable execution of purchased services by selected companies is

not happening either due to lack of time and money. In procurement projects there seems to be a tendency towards more functionality (alignment of purchasing with the city's ambition), next to legality.

Although there are (social demographic) similarities between the three case organizations, there are differences in the speed of their roadmap towards the climate neutral city. In general, municipal procurement policies are compliant with legal requirements as demanded by AW2012 with the add-on of the PIANOo sustainability guidelines, per product category. The incorporation of sustainability is not significantly supported by law because all mentioned sustainable requirements are without any obligation. As stated before, intentions are present, but there is no move forward from legitimacy and legality to appropriateness and efficiency.

In this study, legal forces show similarities with political forces. Together they put pressure on sustainable procurement. Political pressure within and from the Administrative Board (mayor, aldermen) eventually lead to adjustments in national law. From that point, local purchasing officials commit themselves to new rules and regulations. Pressure on top management in the central organization is evident, but real pressure from the market is felt within decentralized purchasing departments. Sector organizations lobby on political level and individual companies exert pressure on requirements and criteria in the smaller purchasing projects. Incidentally, this pressure leads to adjustments in individual projects.

NGOs and labelling institutions are monitoring public procurement in order to reach their own objectives. They succeed in obtaining attention from city council members and have their viewpoints and hallmarks taken seriously. Most positively, they inspire instead of forcing new policies. Nowadays, city administrations acknowledge the role of citizens in developing a local strategy together. More and more, citizens are consulted for city planning programs. Besides, citizens are stimulated to participate in the pursuit of local goals such as the climate neutral city. In spite of initially expected interaction between actors (stakeholders), they respect and sometimes consult each other but never in a structural way.

Legislation should support the step from legality to functionality by taking an effort to make overall procurement legislation more 'agile', by bearing best practices in mind and adding these into a more dynamic legislation. As a result, purchasing officers will adapt functional criteria with more ease and confidence. From this perspective, legislation will become 'evidence based'. Currently, public agencies have a delayed response to societal and political discussions and the, permanently applied, PIANOo guidelines are regarded as 'old fashioned'. The needs of purchasing professionals with sustainable procurement objectives often exceed these outdated rules and regulations.

Next to these encouragements, the sector organization (VNG) must modernize its standard 'procurement strategy format' to the new legislation (AW2012) with its options for sustainable procurement, innovation and collaboration/co-creation.

Municipalities can benefit from the lessons learned within the three case organizations and could anticipate on the impact from the external forces on the procurement function. This study shows that local stakeholders are not interested in and not involved in the procurement achievements by local authorities. Not even local politicians are interested in purchasing policies and strategies and regard these as internal administration affairs and implementation of the local governance agreement.

This study is based on data from three midsized municipalities in the Netherlands which makes the sample too small to turn specific observations into general conclusions. Still, it is to be expected that research within comparable sized municipalities give similar results.

The paper has addressed an important topic with a novel angle, namely focusing on the external actors and factors influencing the adoption of sustainability related criteria in public procurement. We reported an apparent limited effectiveness of laws, guidelines and regulations on the adoption of sustainable public procurement. Future studies could address issues related to the effectiveness of legal pressure, for instance by investigating the gap between perceptions of legal pressure and the lack of enforcement.

This study provides a clear indication of the importance of the smaller purchasing projects on the development and the overall success of sustainable procurement. Future research may focus on the drivers and barriers for sustainability within the decentralized functional departments and the external actors and factors that could transform behavior on a structural base.

Major changes in sustainable public procurement take place within member states of the European Union. It is recommended to execute a ‘pan-European study’ into the external actors and factors and their impact on the development of sustainable procurement within Europe. Such research will make it possible to monitor the developments on a broader scale and will further add to the “EU Buying Green Handbook”.

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Mission impossible: how to make early supplier involvement work in new product development[1][2]?

Arjan J. van Weele[b],
Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, 5600 MB Eindhoven, The Netherlands

[a] Corresponding author:
[b] a.j.v.weele@tue.nl | +3140 247 2170

Abstract

Large companies have embraced the idea of open innovation. They realize that in order to speed up development and reduce risk, they need to collaborate with supply and knowledge partners. However, mobilizing partner specialist knowledge seems problematic. Academic research demonstrates contrasting results. In some cases, supplier collaboration in new product development i.e. early supplier involvement may create large benefits. In other cases, it may lead to detrimental and even devastating results. This paper discusses why these contrasting results are found. It draws on over 30 years of academic research that has been conducted and/or supervised by the author. We conclude that, as the drivers and enablers of early supplier involvement today are clear, fostering effective human interaction aimed at sensitive knowledge and information exchange on behalf of organizations with conflicting interests is crucial in early supplier involvement. As the human factor in technology driven organizations is often undervalued, more research is needed to understand how to mobilize interorganizational knowledge sharing in such exchanges.

Keywords: innovation, early supplier involvement, knowledge management, supplier collaboration

Submission category: supply chain innovation

Introduction

In order to survive in today's rapidly changing global economies, companies need to innovate. Products, processes and business models need to be adapted continuously to meet the ever-changing business requirements and consumer needs. As most products and services today have a large supplier content, companies need to rely on knowledge and expertise of their supply partners. Mobilizing their supply partners to share and integrate their knowledge and expertise allows global manufacturers to speed up new product development (NPD) time and reduce risk. However, early supplier involvement is not a guarantee for NPD success. Hartley (1997) reported in her research that was conducted among 79 companies in the electromechanical industry that engaging suppliers early in NPD did not result in lower product cost, better products or reduce cycle times. On the contrary. Her findings were identical to those of Birou (1994), who reported even higher product and development cost as a result of early supplier involvement, combined with a lower product quality and longer time-to-market. Eisenhardt

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[2] This paper elaborates on an earlier version that was submitted as a chapter for publication in Moreira, A. and Ferreiro, L. (eds), 'Innovation and Supply Chain Management', Springer Verlag (forthcoming)

(1995) completed this picture with similar results, contrasting earlier research that presented successful cases on early supplier involvement.

Clark (1989) reported in his study on Japanese car manufacturers, who were able to reduce engineering hours significantly as a result of earlier and extensive supplier involvement. A finding that was equal to the landmark study on the American and Japanese car industry by Womack et al. (1990). Also, Ragatz et al. (1997) reported positive effects of engaging suppliers early in new product development. These studies reported on significant improvements in terms of product quality and cycle time. These results were substantiated later by Primo and Amundson (2002), who found positive effects when studying 38 projects in the electronics industry.

Engaging suppliers early in new product development seems not without trouble and may easily lead to disputes and even court cases. A recent example is Apple which ran into problems in its relationship with Qualcomm[3], that sued Apple because of infringements of intellectual property (on Force Touch and energy management). Moreover, being aware of Apple´s impressive profit margins, Qualcomm wanted to change its revenue model from a fixed price per chip to a percentage of Apple´s XPhone sales price, as a compensation for its development work. This request was unacceptable to Apple. As this dispute could not be settled in close harmony, Qualcomm sued Apple in China to stop the sales of its new XPhone immediately.

This example shows problems that may occur when working with suppliers in new product development: conflict of interest, knowledge misappropriation, a fair return on development cost, and a fair sharing of new product development outcomes. However, many other problems may impede successful collaboration in new product development.

Based on these observations during the mid-nineties, the questions emerged: ´Why are results and outcomes of early supplier involvement so controversial? What explains the different outcomes of these studies? What truths and threats are lying behind this often advocated practice of early supplier involvement? How to optimize supplier engagement in new product development or is this a mission impossible?´ These questions have been leading many research projects that we conducted and supervised over the past decades. As it will become clear, there was not a single study that was able to cover all of these questions. On the contrary: previous studies were necessary to create a fair understanding of early supplier involvement as a phenomenon. Research findings were fed into new research designs, leading to additional insight.

In the remainder of this chapter we will discuss the outcomes of the main (PhD)-research projects which we initiated and supervised during the past decades. First, we draw on previous work conducted by Wynstra (1998), who revealed the main areas and processes underlying early supplier involvement. His work predominantly covered how to manage Early Supplier Involvement (ESI) at the *inter-organizational level*. Next, we discuss research that was conducted on assessing effects of supplier involvement in new product development. Here, we will base our discussion on work conducted by Van Echtelt (2004). This work covered how to manage ESI at the *project level*. And finally, we will discuss the effects of both contractual and relational governance on innovation outcomes. In doing so, we will draw upon recent studies conducted by De Vries et al. (2017). These studies show that early supplier involvement is about creating both careful contractual and relational governance aimed at fostering inter-organizational, human interaction to foster knowledge sharing behavior among technology experts. This research discusses ESI at the *relational and individual level.* After our discussion of these studies, we will put these into perspective, and discuss several managerial implications.

[3] See: https://www.digitaltrends.com/business/apple-vs-qualcomm-news/

Obstacles preventing early supplier involvement in new product development.

Many obstacles prevent effective early supplier involvement in new product development. These are partly due to limitations of the actual theories in use (Argyris (1990))[4] within companies. For another part these obstacles are present due to ill-defined processes on how to engage suppliers effectively. These obstacles may relate to the manufacturer organization, the supplier organization and to the manufacturer supplier relationship. We will discuss these topics shortly.

Supplier involvement is defined here as: "the contributions (capabilities, resources, information, knowledge and ideas) that suppliers provide, the tasks that they carry out and the responsibilities that they assume regarding the development of a part, process or service for the benefit of a current and/or future buyer´s product development projects" (Van Echtelt (2004), p.27).

When studying early supplier involvement in new product development, different theories can be used. A popular theory is transaction cost economics (see e.g. Williamson (1979)), which holds that buyers will predominantly seek for transactions resulting in lowest total transaction cost. Transaction cost include development and manufacturing costs, logistics and transportation costs, administrative cost etc. Companies that operate from a transaction cost perspective will predominantly consider cost and financial aspects as the prime consideration in supplier selection and decision-making. This usually results in a short-term orientation: investments made in suppliers should preferably generate a short-term return. This transaction cost orientation seems in conflict with new product development, as supplier investments will only materialize on a longer-term.

Another important theoretical perspective which we feel relevant here is the Principal-Agent theory (Eisenhardt (1989)). This theory assumes that, in commercial relationships, business partners will suffer from four basic problems. First, conflict of interest will arise as the buyer wants to spend as little as possible and the supplier intends to generate as much income from the relationship as possible. Secondly, the relationship may suffer from information asymmetry. Usually, the buyer is not aware of the problems that a supplier may incur in developing, testing and actually manufacturing and delivering a component. Whereas the supplier may not have a complete picture of the environment in which his component is embedded in the final product. The supplier may also not be informed about how the final product is being used by the buyer´s end-user. Thirdly, parties may suffer from risk. In commercial relationships, the buyer attempts to shift most of the risk to the supplier, whereas the supplier attempts to do the same in the relationship with the buyer. Usually this problem of risk allocation is solved by negotiating complex contracts, where duties, risks, liabilities, indemnities and guarantees are described in a high level of detail. It is assumed in such situations that all risks can be identified and arranged for beforehand. However, in practice risks may occur that were not foreseen. This is general practice in innovation and new product development projects, which by definition are surrounded by risks and uncertainty. Finally, agency theory holds that parties may suffer from moral hazard. This relates to a lack of trust and respect that the other party will have for the interests of the other party.

We conclude that holding a transaction cost theory perspective will lead to an overly short-term and financial orientation toward engaging suppliers in new product development projects. Whereas the agency perspective (the supplier needs to act in the interest of the buyer) may lead

[4] Theories in use: 'Those theories that are implicit in what we do as practitioners and managers. They govern actual behavior and tend to be tacit structures' (Argyris et al. (1974), p. 30. Argyris et al. argue that people have mental maps with regard to how to act in situations. This involves the way they plan, implement and review their actions. It is these maps that guide people's actions rather than the theories they explicitly espouse.

to a situation where a buyer will try to mitigate its risk and liabilities by shifting these to the supplier. We suggest that other perspectives than the transaction cost perspective and agency perspective may be used to guide buyer supplier collaboration in new product development.

The transaction cost and agency perspectives are reflected in a few main problems and challenges that have been reported in previous research to relate to early supplier involvement (Van Echtelt (2004), p.34-35):

- Loss of knowledge and skills: intensive collaboration with suppliers in product development poses potential risks for loss of proprietary knowledge and the loss of skills crucial for future product development.
- Supplier technology lock-in: in fast-changing high-tech environments, companies risk becoming locked into a supplier's technology (as is the case with Apple in its relationship with Qualcomm)
- High relationship costs: companies that involve a supplier earlier in the product development process or that collaborate in technology development need to spend more time and bring together different management styles and budgeting processes. This implies time and effort being spent on coordinating the work between the two collaborative parties.
- Reduced product development speed: involving suppliers can even slow down the overall development process, since several design iterations and technology alignments may be necessary before arriving at the final design and product.
- Diverging objectives, interests and levels of commitment: already at the beginning, parties may have different objectives and interests. This may be because of different views on how to recapture past investments among stakeholders. Moreover, expected results may change over time and unforeseen circumstances may arise which could give rise to relationship conflicts. Another challenge is related to the free rider problem: how to prevent that suppliers, that take part in a product development project, take it easy and wait for others to take the initiative?

Apart from these problems other problems are that both parties may be unwilling to take risks in establishing relationships, may have limited experience in new product development, may embark on a project without clear agreements, may have misunderstandings about how each organization functions and may have different cultures. Furthermore, disagreement may occur about sharing the pains and gains of the collaboration. Some problems may be related to the supplier organization, where the supplier conveys a need to capture and secure business on the short-term, be overly price sensitive and may work with incapable engineering staff and sub suppliers. Other problems may relate to the manufacturer's organization, where the different business functions (research and development, purchasing, production) are insufficiently aligned, where the culture is characterized by a not-invented-here syndrome, and supplier knowledge is seen as a threat to jobs in the research and development organization.

We conclude here, that effective early supplier involvement suffers from many challenges and problems that are not easy to overcome. These problems may be due to the manufacturer organization, the supplier organization and the relationship between parties involved. Next, these may originate due to an ineffective theory in use. We would argue here that theoretical perspectives, other than the Transaction Cost Theory and Agency Theory, such as the Resource Based View of the firm, Resource Dependence Theory (Brown and Eisenhardt, 1995) and Stewardship Theory (Davis et al., 1997) may be more useful lenses to study and understand complex interorganizational collaborations.

We start our journey to understand the intricacies of ESI with a discussion of Wynstra's work, which was aimed at understanding the key processes that need to be in place at the organizational level to benefit from ESI.

ESI from an organizational perspective: from early purchasing involvement to timely supplier involvement.

Wynstra (1998) observes that increasing specialization in European industry explained the manufacturers' decreasing share in the added-value of their own products (p. 1). Since part of the production activities, that were previously carried out by the manufacturer, were outsourced to suppliers, manufacturers became more dependent on the resources of their suppliers. As a result, the impact of the purchasing function of a company on its production value increased. This would lead to a different role of purchasing within those organizations. Following Axelsson et al. (1984), Wynstra distinguishes three different roles for purchasing, i.e. a rationalization role, a network or structure role and a development role. The first relates to purchasings' task to contribute to the firm's competitive strength by minimizing total cost of production, logistics, prices of inputs, etc. The second role relates to handling the firm's supplier network and managing the degree of dependency of the firm on specific suppliers. The third role concerns systematically matching the firm's technological development with the capabilities of suppliers and the supplier network. Based on this, Wynstra (1998, p. 65) defines purchasing involvement in product development as: "contributing knowledge, taking part in managerial processes and participating in decisions with regard to product development, from a perspective of purchasing, i.e. striving towards lowest possible total product cost, well-balanced dependencies on suppliers, and an optimal technological match with suppliers" .

As Wynstra intends to explore purchasing's contribution to new product development, he elaborates on this development role. In his view this role, essentially, consists of four key processes: prioritizing, mobilizing, coordinating and timing (p.67). *Prioritizing* concerns the choices manufacturers have to make on how and where to invest available resources. Following Håkansson (1989), *prioritizing* not only concerns the choice of actual collaboration partners, but also the choice for a specific form and intensity of supplier involvement. *Mobilizing* involves motivating suppliers to start working on a particular development. Whilst *coordinating* involves the adjustment and adaptation of development activities and resources between suppliers and manufacturer. Without coordination, joint development will result in poor integration of components, double work, incompatible technical solutions, etc. Of course, this need for coordination grows as a result of increasing specialization and fragmentation of development activities across different supply chain partners. Finally, *timing* requires the meticulous coordination and adaptation of development activities and resources across time. Without timing, product development will suffer from unexpected bottlenecks, unnecessary delays and missed deadlines. Having defined these four key processes, Wynstra argues that these are to be applied in *three areas i.e. suppliers, technologies and projects*. The challenge for companies is how to manage these processes across these three areas. The author concludes that therefore early purchasing involvement essentially is a cross-functional activity, which should not be exacerbated by functional boundaries within organizations. Following Dowlatshahi (see Figure 1), he argues that silo thinking in organizations, especially between purchasing, and research and development, is a major risk when collaborating with suppliers in new product development. The author then sets out to explore the mechanisms underlying these processes and areas in nine comprehensive, longitudinal case studies.

Figure 1. Purchasing and development orientations lead to contrasting interests (Dowlatshahi, 1992)

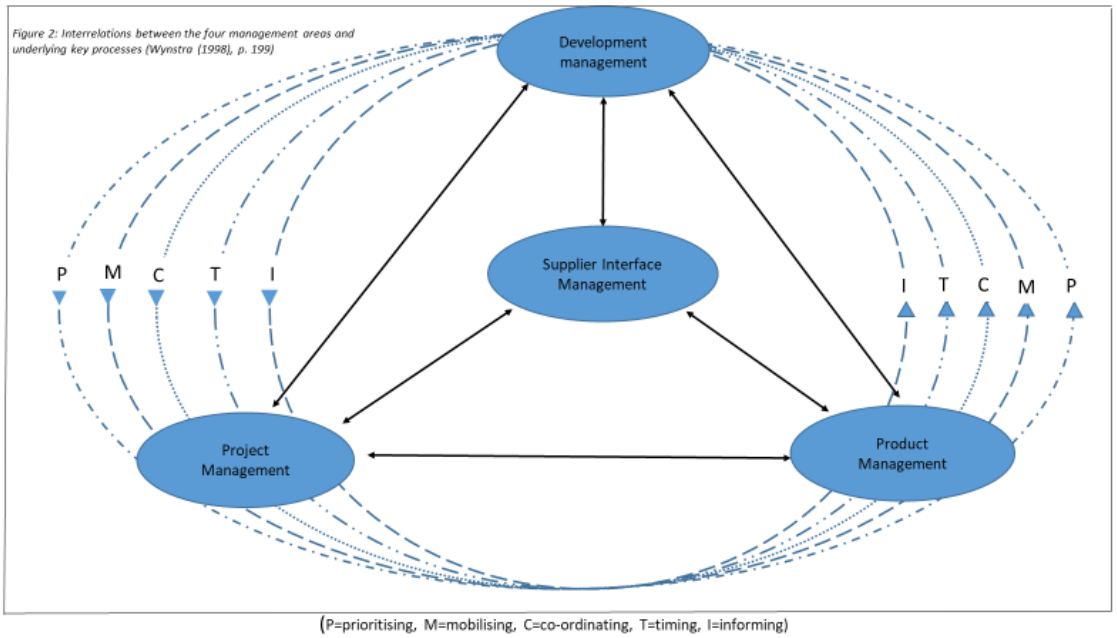
Purchasing orientation	Development orientation
• Minimum acceptable margins of quality, safety and performance • Use of adequate materials • Lowest ultimate cost • High regard for availability • Practical and economical contributors, specifications, features and tolerances • General view of product quality • Cost estimation of materials • Concern for just-in-time deliveries and supplier relationships	• Wider margins of quality, safety and performance • Use of ideal materials • Limited concern for cost • Limited regard for availability • Close or near perfect para meters, specifications, features and tolerances • Conceptual abstraction of product quality • Selection of materials • Concern for overall product design

Based upon these nine in-depth case studies, the author identifies five management areas that should be covered when engaging suppliers in new product development processes:

- Development management. Development management includes a clear strategy on what technologies to keep or develop in-house and which ones to outsource to suppliers. It also relates to policies that are in place on how to effectively engage suppliers in new product development in the relationship with internal business domains within the firm. Without development management, NPD projects will suffer from a lack of guidance and suffer from politics.
- Supplier interface management. This includes monitoring supplier markets for new technological developments that may be relevant for the company. It also includes pre-selecting suppliers per key technology area and exploiting their technical capabilities. Finally, it includes also the monitoring and evaluation of a supplier´s development capabilities and performance.
- Project management. This activity can be distinguished into two sub activities i.e. planning and execution. Project planning includes the actual decisions on a project level on what to develop inside or outside the company. In case of the former, the actual decision is made on what suppliers to engage in the project and when to do that. Project execution includes introducing and onboarding the supplier with the firm's business strategy, domains, projects and engineers. It also includes the actual orchestration of the activities of first tier suppliers in their relationship with second tier suppliers. Finally, it includes the ordering and approval of prototypes and managing technical changes and variations.
- Product management. This activity includes evaluating product designs in terms of part availability, manufacturability, lead-time, quality and cost and promoting standardization and simplification of designs and parts across products and suppliers.

To be able to engage suppliers in new product development effectively, each of these four activities need to be managed by the firm to some extent. Preferably through a concerted action by all internal stakeholders involved. Enabling factors that foster a successful execution of each of these four management areas are: the internal organization of the purchasing department just as the development team, the access to and availability of human resources information including quality performance. The last finding leads the author to conclude to a fifth key process: *informing*.

When summarizing, Wynstra argues that the involvement of purchasing in a product development project should aim to realize or contribute to five (instead of four) key processes: prioritizing, mobilizing, coordinating, timing and *informing*. These five key processes should focus on four management areas including new product development, supplier interface management, project management and product management. Valuable suggestions are: not to talk about early purchasing involvement but, rather, stress the role of suppliers in fostering and improving new product development success. Next, we recommend to talk about *timely* supplier involvement rather than *early* supplier involvement as it is important to engage suppliers, based upon their capabilities, at the right time and the right level of responsibility in a new product development process (see Box 1). The role of the human factor should not be underestimated.



Box 1 The supplier involvement portfolio (Wynstra et al. (2000))

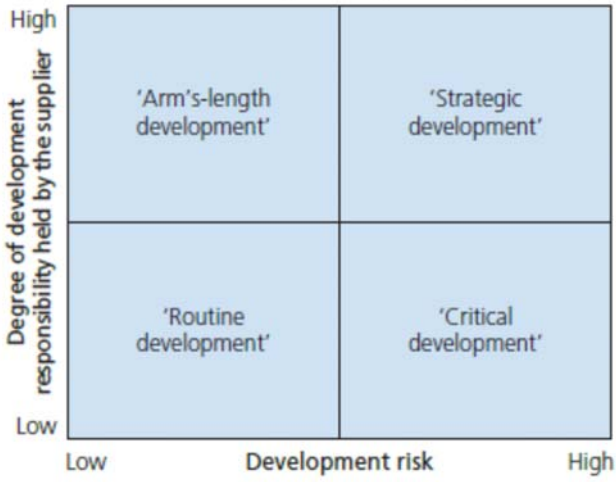
The objective of the supplier involvement portfolio is to provide guidance for setting priorities with regard to the involvement of suppliers in new product development. It will help companies to mobilize supplier expertise in the best possible way. As not all suppliers are equally important, only very few need to be engaged early. Other suppliers may be involved later, whereas most of the suppliers will be involved when the product design has been fully tested and is frozen. The portfolio
distinguishes four types of supplier involvement based upon two variables: (1) the degree of responsibility for product development that is contracted out to the supplier, and (2) the development risk involved (see Figure 3). Suppliers may assume responsibility for component design in four ways:

- Functional specifications. Based upon functional specifications for a component or module, the supplier is responsible for conceptual design, detailed design, prototype, testing and setting up its production and assembly process.
- **G**lobal design. Here, the buyer communicates a rough design to the supplier, who needs to work out a detailed design and submit this for approval to the buyer. When approved, the supplier is responsible for prototyping, testing and manufacturing.

- Detailed design. The supplier is responsible for submitting a prototype or sample to the buyer for approval, which is tested. Next, the supplier is responsible for setting up production and assembly.
- Standard design. Here the buyer decides to integrate a standard component in their product design. After the product design has been tested and is frozen, the supplier is requested to submit a price proposal and production planning.

Development risk is related to a number of factors. Examples are: the component is new to the buyer, the buyer is unfamiliar with the functionality of the component, criticality of the component for the buyer's product functioning, the component is on the critical path of planning and, the number of technologies represented in the supplier's component. Based upon these criteria, an assessment on part-level can be made per project to assess whether the buyer falls short in terms of knowledge and expertise. Those are the parts where specialized suppliers will be engaged early in the new product development project. Standard parts come with low risk in general and low technical complexity. Suppliers of standard parts therefore can be engaged late in the process. This is how the supplier development portfolio may guide buyer decision-making on ESI, which is better referred to as timely supplier involvement (see Figure 3).

Figure 3. The purchasing development portfolio (Wynstra et al. (2000))



The value of Wynstra´s work is that he provides a detailed insight into what it takes to engage suppliers within the product development processes of the firm, distinguishing the degree and timing of supplier involvement. A lot of processes need to be in place, in order to align the supplier contributions and match technology needs. Furthermore, enabling factors need to be organized in order to put these processes in place. As companies do probably not have all these processes in place equally, this may explain the different outcomes of early supplier involvement among companies and sectors.

Shifting suppliers into gear: effective supplier collaboration in NPD projects.

Building on Wynstra´s groundwork, Van Echtelt (2004) investigates the way in which inter-organizational collaboration, and specifically vertical collaboration between the manufacturer and its supplier, can strengthen a company's capability to develop new products. Again, the ´aim of this study was to identify what the critical processes are for managing the involvement of suppliers to lead to improved performance in product development´ (p.1). Van Echtelt observes that companies are being forced to develop and implement new strategies just as ways

to organize their product development function. In general, companies may pursue three different strategic and organizational responses: 1) outsourcing new product development, 2) concurrent development and cross functional collaboration, and 3) inter-organizational collaboration. The author observes that companies increasingly engage in collaborative arrangements with other companies in the area of technology and product development (p. 7). He further argues that this was in contrast to the more traditional arm's length supplier relationships in combination with a complete reliance on suppliers' development capabilities. Collaboration with other companies became a mechanism for tapping into external resources of knowledge to speed up development. Next, through supplier collaboration financial risks could be shared in developing new products. Supplier collaboration can however assume different, hybrid forms as well, such as mergers, acquisitions, joint ventures, strategic alliances, license agreements and collaborative arrangements with suppliers. With regard to the latter, Van Echtelt observes that there is a lack of sufficient empirical understanding of critical processes and conditions underlying effective supplier involvement that allow companies to attain short-term product development targets and long-term business goals. Next, he developed a framework that identifies the objectives, critical activities and conditions for effectively leveraging suppliers in product development. Again, this researcher builds his research on in-depth case studies, which are conducted at eight NPD projects at a global high-tech manufacturer. These case studies were followed by four additional case studies taken from NPD projects of companies in other business sectors.

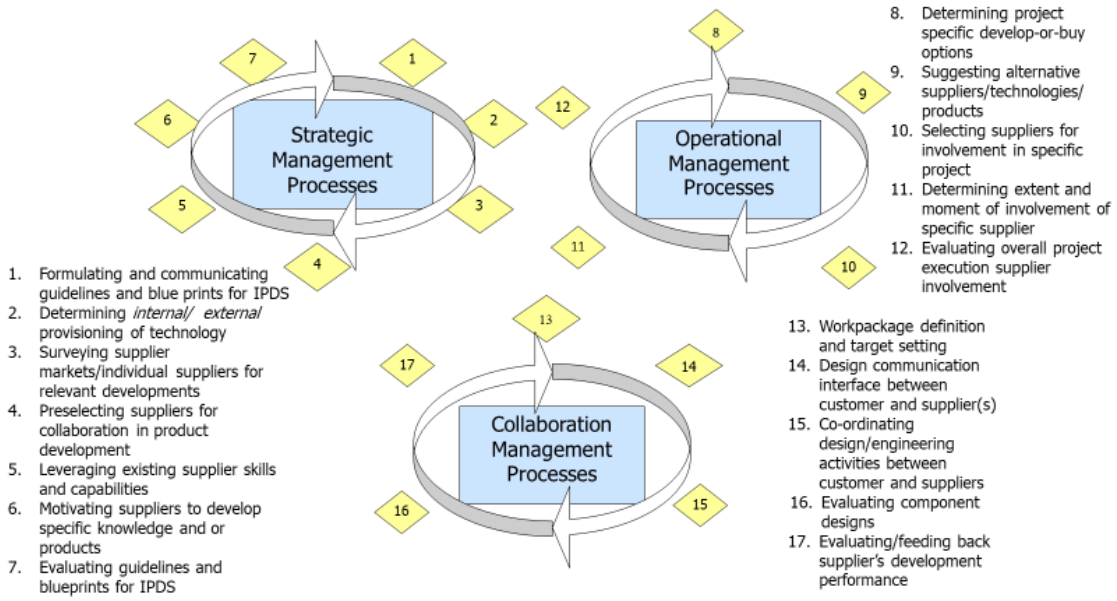
Based upon his extensive work, a number of adaptations to Wynstra's framework for analyzing management of supplier involvement are suggested. First, three instead of four relevant managerial arenas are suggested, i.e. the strategic management arena, the project management arena and the collaboration management arena (p. 264). A major reason for this is that companies may need to focus on managing individual collaborations with suppliers. As Van Echtelt (2004, p. 264) argues: "adopting a relationship view actually is like black boxing a phenomenon that itself is driven by events in different collaboration episodes that together drive an evolving relationship". As development projects aim at realizing both short-term and long-term objectives, the author maintains Wynstra´s original idea of the strategic management arena and project management arena. Here, only few ideas are added. However, the collaboration management arena includes activities aimed at designing the appropriate collaboration form, executing development activities in an individual collaboration and learning from each collaboration episode. For each of the three arenas, critical management processes are identified, which need to be managed collectively (see Figure 4). More specifically, the three management arenas seem to follow basic iterative cycles, rather than being sequential in nature. Based upon his extensive work, the author concludes that important enablers for making this integrated new product development framework work, are: collaboration between purchasing and research and development, human resource quality, recording and availability of information. Here, we conclude that most of the enabling factors that were identified by Wynstra, are confirmed.

The implications of this study are clear: if companies have made many efforts and have spent significant time in defining and describing critical management processes, these will not be successful if projects suffer from silo thinking, political plays between purchasing and research and development, lack of information support and management reporting, and lack of human resources.

The value of Van Echtelt´s work is that he translates his research results into a coherent and pragmatic audit tool, which can be used to assess the maturity of both the manufacturing and supplier organization for collaboration. The outcomes enable companies to either improve their processes and/or enablers for successful future collaborative innovations. In doing so they

might focus on putting things right first before embarking in joint collaboration in new product development.

Figure 4. Schematic overview of Van Echtelt´s Integrated Product Development and Sourcing framework (2004; adapted by the author)



Both Wynstra's (1998) and Van Echtelt´s (2004) research reveal the key areas and critical processes that need to be in place to allow for effective supplier collaboration in new product development projects. Both studies emphasize the importance of cross-functional teamwork among research & development engineers and purchasing professionals: an open atmosphere to exchange information between parties involved and the role of human resources. Enabling cross-functional collaboration, in essence, occurs at a person-to-person level, and thus may explain why supplier involvement is successful in certain cases and in other cases not. This insight was the reason to further deepen our initial research questions to include: what exactly motivates supplier specialists to contribute to the innovation goals and objectives of a manufacturer during collaborative innovations projects? Here, the inter-human dynamics within innovation teams needed to be more clearly understood such as the psychological factors and processes that affect inter-organizational and intra-organizational knowledge exchange. As a result, we became particularly interested in the social and human factors behind supplier involvement, which was the trigger to the next series of studies.

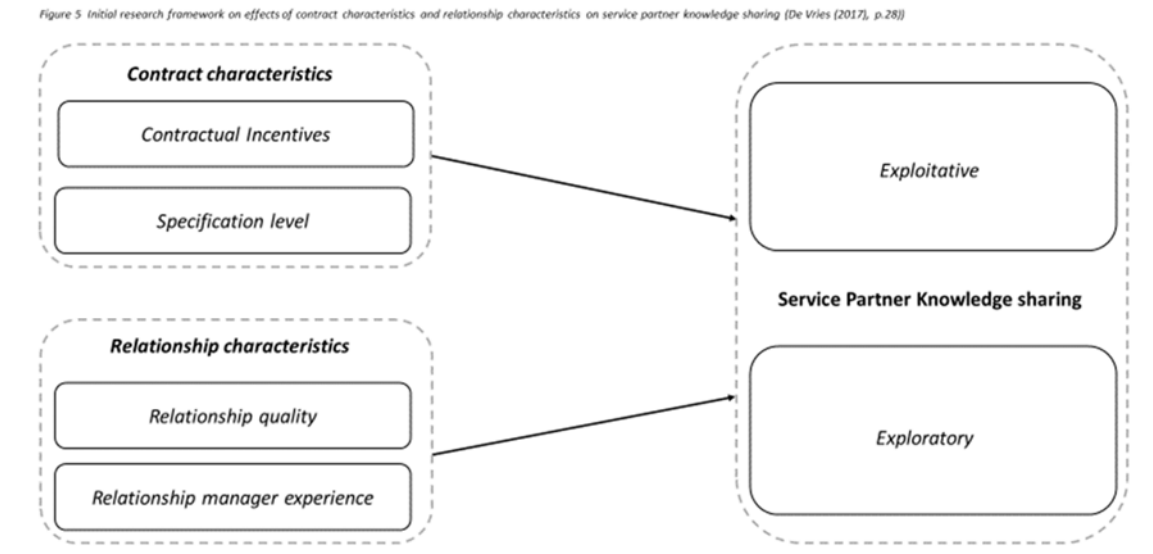
How to release external expertise: effects of relational and contractual governance

Following upon the previous research, De Vries (2017) conducted three studies aimed at understanding the psychological factors that influence actual knowledge sharing in interorganizational collaboration in new product innovation. His studies were different from the previous ones. Through Wynstra's and Van Echtelt's work, we intended to obtain in-depth insight in the mechanisms, processes and enablers underlying early supplier involvement. Hence, these studies were explorative, qualitative and case based. Through De Vries' research we intended to assess the effects of human interaction in conflicting interorganizational settings. More specifically, we were interested in discovering the actual drivers underlying effective

inter-human information and knowledge exchange, as information management and exchange emerged as a key enabler from the previous studies. Therefore, De Vries's research is of a different nature, i.e. quantitative and more specific in terms of independent and dependent variables. Here, we report on two of the three studies.

The first study, which was conducted among 70 experienced relationship managers at a large, global electronics manufacturer, was aimed at investigating how contractual and relationship characteristics enhance exploitative and exploratory knowledge sharing by service partners to whom manufacturers have outsourced customer facing services (De Vries (2017), p.18). As many manufacturing firms today outsource aftersales services to third-party service providers, these service providers have become crucial for the knowledge exchange about quality and usage behavior by end-users. Manufacturers can greatly benefit by integrating knowledge on post sales experiences by end-users into their new product designs. However, how could manufacturers capture such knowledge from these service providers? To address this question, the effects of both contractual governance and relational governance on knowledge sharing behavior were investigated. A distinction was made between exploitative knowledge sharing (aimed at obtaining knowledge to improve existing products and processes) and explorative knowledge sharing (aimed at obtaining knowledge to create entirely new products and processes). Effective knowledge sharing was, in line with organizational learning theory (Bell et al., 2002) deemed necessary for delivering successful innovation projects. Figure 5 provides a schematic overview of the research model. Contractual governance was explained by using two sets of variables: one was related to contractual incentives. The other set was related to contract specifications. It was hypothesized that both variables would positively affect service partner knowledge sharing behavior. With regard to relationship characteristics the differentiation was made between relationship quality and relationship manager experience. Relationship quality was measured by assessing the level of cooperation, responsiveness, empathy, assurance and trust among parties. Also, for these variables a positive effect on knowledge sharing behavior was assumed.

Figure 5. Initial research framework on effects of contract characteristics and relationship characteristics on service partner knowledge sharing (De Vries, 2017, p. 28).



Using multivariate analysis, the findings were the following. First, clearly defined contracts seem to be characterized by higher levels of knowledge sharing. Positive relationships were found between the level of contract specification and knowledge sharing. Which confirmed earlier research that unclear contract specifications hinder knowledge transfer. Unarticulated expectations leave service partners guessing for desired performance levels, resulting in disappointing service performance. We conclude that clear contractual specifications provide a frame of reference that makes a service partner share those insights that provide value to a manufacturer. Secondly, a strong negative relationship between contractual incentives and exploratory knowledge sharing was found. This negative relationship was not found in the relationship with exploitative knowledge sharing. As the study shows, contractual incentives focus suppliers on realizing short-term objectives and gains and reducing risks that could jeopardize the realization of agreed incentives. Contractual incentives avoid suppliers to think out-of-the-box. However, they may be useful when pursuing exploitative knowledge sharing aimed at continuous improvement or improving existing product and process designs. Thirdly, a positive relationship was found between relationship quality and both types of knowledge sharing. Relationship quality builds a long-term commitment among parties and as a result, both are willing to make idiosyncratic investments to the relationship. Experienced relationship managers may also trigger explorative knowledge sharing as they seem to better manage and guide the interactions with the service partner. This is important to note, as changing relationship managers too frequently and within a too short period of time, will be detrimental to exploratory knowledge exchange and, hence, collaborative innovation outcomes.

Concluding, the value of this research is that it shows that both contractual governance and relational governance seem to affect knowledge sharing between partners in collaborative innovation projects. Of course, with regard to contractual governance, this research only tested the effects of contract specification and contractual incentives. Clear contractual specifications are required to guide the development activities among innovation partners. Contractual incentives, in general, foster incremental innovation. However, they do not seem to foster radical innovation. On the contrary, relationship quality is positively related to knowledge sharing and therefore a key variable for driving collaborative innovation. Therefore, it does not come as a surprise that tenured relationship managers, who build on their past experiences, seem important in building trustful relationships.

Exploring the drivers of human interaction and knowledge sharing in NPD projects.

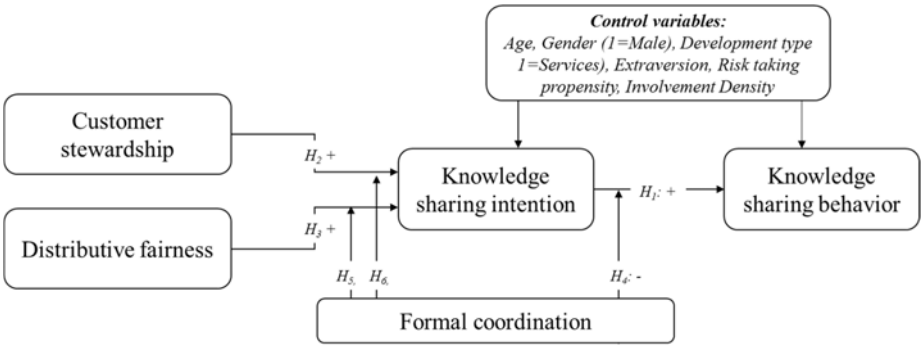
The previous study indicated that relational governance seems important in collaborative innovation projects. Especially cooperation, responsiveness, empathy and trust correlate positively with knowledge sharing. This all may be true, but what makes supplier engineers actually share their knowledge? This was the major research question underlying a second, quantitative follow-up study among 187 supplier technical engineers, who were engaged in collaborative innovation projects of seven global high-tech manufacturers (De Vries, 2017, p. 42). This research was deemed relevant since evidence from practice showed that engaging suppliers and integrating supplier knowledge into new product designs was not without problems. As an example may serve here: Goodyear, the global tire manufacturer. Its tire engineers imitated a technological innovation of the supplier, whose employees had been involved in an R&D project. Next, this supplier's technology was pushed out of the new product and the supplier did not get a fair yield on its contribution (De Vries 2017, p. 41). Similar experiences have been reported in the relationship between Compuware and IBM (Cowley & Larson, 2005) and Lexar Media versus Toshiba (Thomas, 2003). These cases suggest that suppliers do not always get a fair return for their development work in collaborative innovation projects. This makes technical engineers cautious, as they have to consider both the

responsibility to advance the manufacturer's business as well as obtaining a fair reward for the supplier´s development efforts.

Clearly, knowledge misappropriation and unfair distribution of rewards in collaborative innovation projects may lead to misalignment of interests, and hence may demotivate supplier engineers to share their knowledge with their clients. Therefore, this follow-up study aimed at investigating the importance of alignment of interests and economic rewards in collaborative innovation projects. Here, fairness theory (Fehr & Schmidt, 1999) was used to explain how individuals balance their invested efforts against expected outcomes. Fairness theory holds that when the balance is assessed as fair, self-regulation motivates individuals to contribute to collaborative innovation projects. Next, stewardship theory (Davis, Schoorman, & Donaldson, 1997) was used which defines stewardship as an individual's (here: supplier engineer) felt ownership and responsibility for the manufacturer's overall welfare. Based upon this, it was hypothesized that customer stewardship would positively influence knowledge sharing behavior, and, hence, affect collaborative innovation project outcomes positively. In line with Golden and Raghuram (2010), knowledge sharing behavior was defined as knowhow relayed to others on an impromptu basis, whereby individuals feel comfortable to spontaneously disclose personal experiences. This definition reflects that knowledge sharing is rather an interpersonal, spontaneous activity, than a planned or programmed activity. Knowledge sharing behavior was defined as the actual disclosure of information, whereas knowledge sharing intentions were defined as the willingness to engage in knowledge sharing behavior in the near future. Based upon these ideas, a preliminary research framework was built and tested (see figure 6).

The framework assumes that actual knowledge sharing behavior in conflicting, interorganizational settings is determined by knowledge sharing intention. Whereas knowledge sharing intention is affected by customer stewardship, and perceived distributive fairness. Through this framework we wanted to assess to what extent the care of a supplier expert's for the manufacturer's interest and his perception of a fair return of his development efforts would affect his willingness to share sensitive knowledge.

Figure 6. Research model for investigating effects of fairness and rewards on knowledge sharing behavior (De Vries, 2017, p. 45-46).



The hypothesized research model explained 33.5% of the variance in knowledge sharing behavior. The results indicate a positive effect between knowledge sharing intention and knowledge sharing behavior. Next, customer stewardship related positively to knowledge sharing intention. Furthermore, a positive interaction effect was found of formal coordination on the relationship between knowledge sharing intention and knowledge sharing behavior. An interesting finding was that a supplier engineers' risk-taking propensity and extraversion related

positively to knowledge sharing behavior and intention. These findings were in line with earlier works, which reported that risk averse individuals tend not to engage in risky behavior such as knowledge sharing. Surprisingly, no evidence was found for the effect of distributive fairness on knowledge sharing intention. However, the moderating effects of formal coordination on the relationship between fairness and intention did turn out to be significant. Therefore, it was investigated what levels of formal coordination (i.e. high, medium or low) could moderate the effect of distributive fairness on knowledge sharing behavior. It appeared that under conditions of low formal coordination, both the alignment of interests (stewardship) and alignment of rewards (fairness) drive knowledge sharing behavior through knowledge sharing intention. However, under circumstances of high formal coordination only alignment of rewards drives knowledge sharing behavior (De Vries 2017, p. 63).

Hence, the degree of formal coordination in collaborative R&D projects seems an important influencer of supplier engineers' motivations to share knowledge. Based upon this research, R&D managers need to make a conscious choice with regards to the level of formal coordination in collaborative R&D projects. They should instruct their employees either to heavily rely on informal coordination mechanisms such as trust and mutual understanding, or to provide strict guidance to supplier engineers by frequently referring to what has been agreed.

When formal coordination is high, managers are encouraged to emphasize the benefits for the supplier of being involved in this project. They should convince the supplier engineer that his/her knowledge contribution allows both parties to attain their business interests. Furthermore, they should secure that future revenues will be fairly distributed over the parties involved. When formal coordination in R&D projects is low, managers may have to do much more. In such a situation they have to make sure that supplier engineers experience a sense of stewardship for the manufacturers well-being. Supplier engineers should be allowed a fair degree of autonomy to work and share know-how in the R&D team. In order to realize this, the manufacturer should explicitly deploy onboarding practices to make the supplier engineers feel at home. Next, they should be appreciative of the unique competences that supplier engineers bring to the table.

Concluding, the value of this study is that it reveals the intricate and sensitive mechanisms underlying knowledge sharing behavior between individuals in collaborative innovation projects. It shows that, in essence, collaborative innovation is a process of human interaction. If this human interaction is not guided through both formal and informal mechanisms, knowledge exchange will suffer and, hence, will affect collaborative innovation project outcomes negatively.

Early supplier involvement: a mission impossible?

After many years of research, we finally have found the answer to the contrasting results of early supplier involvement. First, we have found that ESI operates at four different levels: the inter-organizational level, the project level, the relationship level and the individual level (see Figure 7). When doing so, different research methodologies (qualitative and quantitative) and different theoretical perspectives seem to be helpful. We conclude that, for understanding the effects of ESI, it is not sufficient to limit yourself to one methodology and/or theory only. The contrasting outcomes found in literature on the effects of ESI can be explained by differences among companies and their suppliers on practices and processes on each of the four levels.

Differences found in terms of early supplier involvement outcomes indeed can be explained by the fact that strategic management processes, operational management processes and collaboration management processes are not or not sufficiently in place. However, these differences may also be due to the manufacturer's inability to engage and mobilize supplier expertise effectively in the relationship with the manufacturer's engineers. It is the human

interface that seems to make most of the difference. The main reason for this is that in collaborative innovation, it is all about sensitive knowledge sharing and information exchange between engineers that usually need to operate in a setting with conflicting interests.

Dimension	Core issues	Methodology	Theoretical perspectives	Solutions
Organizational level	• How to create supplier alignment in collaborative NPD (intercompany level)?	• Qualitative, case studies	• Transaction Cost Economics (TCE) • Principal-Agent Theory	• Change from early to timely supplier involvement in NPD • Critical processes: prioritizing, mobilizing, coordinating, timing, informing
Project level	• How to create supplier alignment in collaborative NPD (project-level)?	• Qualitative, case studies	• Resource Based View of the Firm • Resource Dependency Theory	• Three arenas to manage: strategic management, project management, collaboration management • Critical processes: cross functional R&D, human resources quality, information management
Relationship level	• How do formal and informal governance affect buyer-supplier knowledge transfer?	• Quantitative, surveys	• Organizational Learning Theory • Social Exchange Theory	• Arrange for clear contracts: decide about level of formality • Arrange for mechanisms to recoup NPD investments • Arrange for incentives in case of exploitative knowledge transfer • Focus on relationship quality (ie trust, commitment, consistency) to foster knowledge exchange
Individual level	• How does human interaction affect formal and informal knowledge exchange?	• Quantitative, surveys	• Stewardship Theory • Fairness Theory	• Foster supplier stewardship through onboarding • Arrange for fair distribution of benefits and rewards • Arrange for right level of formal coordination • Allow for sufficient supplier autonomy

Figure 7. Early Supplier Involvement Framework: four levels of intervention

Knowledge and information exchange essentially occurs between people, is by definition person to person exchange. Making people share sensitive information both contractual and relational governance are important. Contractual governance is necessary in order to formally align business interests and expectations and to provide for rewards and incentives for the work that is to be delivered by suppliers. Relational governance relates to cooperation, responsiveness, communication, consistency, empathy and trust. It is needed to make supplier engineers feel respected and rewarded for their inputs. Depending on the type of innovation which the company wants to pursue (incremental versus radical innovation) the manufacturer should adapt its rewards and incentives in the relationship with suppliers. In both situations, careful selection of suppliers and their representatives, and deployment of effective onboarding practices are important. When working with suppliers in new product development projects, the manufacturer should secure a fair return on the supplier's inputs and efforts to generate sufficient stewardship and alignment from suppliers. As collaborative innovation projects are unique, so are the teams and the individuals that need to work on these. Different innovation projects represent different technical and commercial challenges that need to be overcome by different teams and people.

What can we learn from the previous studies? What should managers do to benefit from early supplier involvement in collaborative innovation projects? What should be avoided to prevent failure? The lessons are many, as are the challenges ahead. Based our research on collaborative innovation projects, and following our suggested four levels of abstraction (i.e. inter-organizational, project-, relational and individual level), we suggest the following:

- *Arenas and key processes*. Following Wynstra (1998) and Van Echtelt (2004), apart from contracts, formal governance mechanisms should be created around three important processes
    - Strategic management processes
    - Operational management processes
    - Collaboration management processes.

  Each of these processes is to be divided in several sub processes (17 in total) which need to guide internal and external stakeholders, who take part in the innovation project. Regular audits should secure that most of these processes are defined and followed in practice. In many product development projects, we have observed that most of these processes were not in place. In such cases collaborative development teams need to improvise i.e. need to make up their own decisions.
- *Cross-functional teamwork, information management and human resources* are important enablers to foster inter-organizational innovation projects. Cross-functional teamwork should be encouraged and should be in place to avoid suppliers to be confronted with political plays and differences of opinion among the manufacturer's representatives. Information management is necessary to create common IT-platforms for design,- planning-, and data sharing. It is of utmost importance that information systems among stakeholders are compatible and connected. Human resources seem to be a key asset in collaborative innovation projects. Not only in terms of the expertise that is required from both parties, which makes it mandatory that team members are highly qualified and experienced. However, also in terms of the ability to collaborate and operate in teams. This makes it necessary in any innovation project to invest sufficient time and money in project startup and onboarding, to allow team members to get acquainted with the project, what is expected from them, with their own roles and with their colleagues. Having witnessed many collaborative innovation projects, we observe that the necessary investments in these three important enablers are often insufficient.

- *Contractual and relational governance mechanisms.* Engaging suppliers early in new product development successfully requires a fair mix of both contractual and relational governance. It seems that innovative inter-organizational collaborations cannot do without formal contracts. As contracts guide and provide the context of the future collaboration. Development contracts, which stipulate how to deal with intellectual property and how investments will be recouped by both parties, are necessary to manage the expectations of the parties involved. Next, the manufacturer can opt to manage the project in a formal or informal way. The manufacturer should avoid an unclear mix of both, as this will be confusing to the supplier partner. Formal governance mechanisms are important; however, informal governance mechanisms may make the difference. As cooperation, responsiveness, empathy, assurance and trust seem to determine the motivation of supplier engineers to actually share knowledge and contribute to the manufacturer's new product development goals. Here, seniority of the manufacturer's relationship managers and their tenure is important. Contractual incentives may be used to stimulate supply partners to share their knowledge. Incentives are useful when pursuing incremental innovation. They should better not be used when pursuing radical innovation.
- *Contractual governance*. Our research shows that collaborative innovation cannot do without contractual guidance. Here, R&D managers should differentiate between low and high degrees of formality. High degree of formality would create clear guidance to all stakeholders. High degree of formality should be accompanied with a fair sharing of the pains and gains of the innovation project. When R&D managers opt for low formality in terms of contractual governance, they should do more. They should make sure that the supplier engineers feel at home, and feel respected as a valued member of the team. Investing in onboarding practices is inevitable. Being inconsistent i.e. changing between low and high formality in dealing with supplier engineers, will make them uncertain and uneasy and unwilling to share their knowledge and insight. Wrong contractual incentives may exacerbate the problem.
- *Relational governance*. As collaborative innovation seems to be predominantly a human interaction process, the value of investing in the relationship with suppliers can hardly be overstated. Suppliers should be considered by the manufacturer as is an important asset to the company. More particularly, manufacturers should aim for constantly improving the quality of the relationship with business-critical suppliers. Suppliers who have outstanding performance, should be rewarded with more business and deeper engagement in new product development projects. When they do, suppliers should have a fair return on their investments. In case of project failure, the consequences for all parties involved should be clear upfront and remedies in-line with contributions. Professional project management, risk management and relationship management would be necessary to create a climate in which a supplier can contribute.
- *Knowledge sharing and innovation*. As De Vries´s research (2017) shows, collaborative innovation, in essence, seems to be a human process i.e. a process of human interaction and socialization. The process of human exchange aims at knowledge sharing to foster product-, process- and business model innovation. There are many reasons why supplier engineers will not share their ideas freely in innovation projects. One is that they need to overcome conflict of interest, as they need to take care of their own company's interest as well the manufacturer's innovations interest. This conflict is not easily solved. Next, they need to be valued in their area of expertise as an engineer and as a human being. A hostile, ´not invented here´ culture, arrogance, or downright ignorance at the manufacturer, could jeopardize a supplier engineers´ motivation to contribute.

Heading for early supplier involvement: are you ready for it?

Based upon our previous discussion, it is now clear why extant research on the effects of early supplier involvement has produced such contrasting results. Given the many challenges that need to be overcome, early supplier involvement may easily result in disappointment. Joint collaborative new product innovation represents a trajectory which is full of problems, risks and disappointments. Is early supplier involvement a mission impossible or not? It is a mission impossible for those who think that early supplier involvement can be managed as a systematic structured process. But it is not for those who think that early supplier involvement primarily is all about fostering human interaction in conflicting business settings. However, then engaging supplier engineers in new product development is far from easy. When embarking on such a journey, we recommend manufacturers and supply partners to start with the end. Which is: to start with the human side of the enterprise. To establish a cross-functional, cross-organizational team of capable engineers and specialists that are well prepared and equipped for their tasks and which is supported by an adequate (though sparse) governance and project structure. Next, the team should be equipped with sufficient resources. This seems more valuable than to try to structure all 17 processes around the three areas as this will, apart from the huge effort, only provide for limited control and certainty. In reality, every collaborative innovation will develop differently than originally anticipated. The joint project team should be allowed, based upon the manufacturer's initial feasibility studies, to develop their own project mission, restate the project objectives and prepare a global project and work plan. These may serve as the input for an initial, flexible development contract, which stipulates how parties will deal with intellectual property and how investments made will be recovered, i.e. how financial losses will be spread. Rather than working sequentially, parties need to prepare for iterative loops which allows parties based on the progress made, to regularly review and mitigate incumbent project and work plans. Next, the quality of the relationship should be reviewed and discussed regularly to secure that everyone is still committed and contributes. Only then early supplier involvement may turn into a mission possible.

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The Impact of Sustainable Sourcing on Customer Perceptions: Association by guilt from scandals in local vs. offshore sourcing countries

Claire Veit [1], Lieven Quintens [2], Wim Lambrechts [3], Janjaap Semeijn [4]

[1] Maastricht University, School of Business and Economics, Tongersestraat 53, 6211 LM Maastricht, tel. +31433883778, c.veit@student.maastrichtuniversity.nl

[2] Maastricht University, School of Business and Economics, Tongersestraat 53, 6211 LM Maastricht, tel. +31433883778, l.quintens@maastrichtuniversity.nl

[3] Open University of the Netherlands, Faculty of Management, Science & Technology, PO box 2960, NL-6401 DL Heerlen, the Netherlands, tel. +31454762826, wim.lambrechts@ou.nl

[4] Maastricht University, School of Business and Economics, Tongersestraat 53, 6211 LM Maastricht, tel. +31433883778, j.semeijn@maastrichtuniversity.nl

Abstract: This study analyzes whether customer perceptions towards sustainability are affected by a company's country of origin and sourcing strategies. Customer perceptions of company sustainability was found to have an impact on purchasing behavior. This study builds upon the literature about customer interest in sustainable products. It adds the country of origin to the link between customer and company, and analyzes if and how customer perceptions change when they are introduced to a sustainability scandal, hence analyzing possible 'association by guilt'. It compares their reactions to offshore scandals and to local scandals therefore taking spatial distance as an important variable into consideration. Findings show that perceptions are influenced by proximity. Furthermore, companies should take into account the risk of association by guilt when developing their global sourcing strategies.

Keywords: Supply Chain; Sustainability; Customer Perception; Sourcing

Introduction

In a world of scarce resources companies have come to realize that it is not simply a trend but a responsibility to act more sustainably (Prahalad & Hamel, 1994). Irresponsible, unethical or opportunistic behavior has become detrimental for a company´s reputation. At the same time, in order to stay competitive, companies are expanding their businesses globally and outsource non-core activities (Ortas, Moneva & Álvarez, 2014). They build supply chains that consist of a network connecting different partners, countries, and consumers. This growing complexity leads to considerable challenges for sustainable sourcing. One strategy to pursue sustainability is to re-shore (Ashby, 2016). Reshoring brings offshored business back home and may cater to sustainability goals. Growing news coverage of supply chain scandals leads to increasing customer interest in sustainability. These scandals mainly occur at the place of production, mostly developing countries, but cause public outcry in the developed world, where the majority of products is sold (Gualandris, Golini & Kalchschmidt, 2014). Often, the production process has been outsourced to factories belonging to the supplier. This vertical disintegration means that the focal company (FC), which sells the product under their brand name to

(Western) consumers, is legally not responsible for the conditions at the point of production. Nevertheless, scandals may automatically be associated with the FC. Molet et al. (2013) call this phenomenon 'association by guilt'; when two parties are linked to each other, the negative reputation of one can impair the reputation of the other.

This form of supply chain contagion might trigger customer awareness of sustainability and demand for more transparency. Supply Chain Transparency includes vertical as well as horizontal transparency so that all stakeholders and supply chain players have better access to corporate supply chain information (Bastian & Zentes, 2013). In order to create transparency, a firm needs to increase control over outsourced services. One approach is to establish a set of guidelines that suppliers need to follow, concerning child labor, safe work places or waste disposal. This approach is already adopted by multinational companies like IKEA and Danone (Johnsen, Howard & Miemczyk, 2014). Moreover, sharing positive information about sustainability measures is becoming a standard for being competitive (EY, 2014). Thus, rankings of the most sustainable companies have become a popular tool for benchmarking (e.g. DJSI, Global 100, Thomson Reuters ESG Index). Investments in sustainability could also be justified by customer demands for more sustainable behavior (Gualandris et al., 2014). It is however unclear whether they really care about sustainability along the entire supply chain or only at the point of sale when purchasing from the FC.

We take a closer look at customer perception of company sustainability and the link to supplier sustainability by taking into consideration the role of countries. Thus, we use existing literature about the company-customer link and add country influence to the model. The following research questions (RQ) are focused upon:

> RQ1: Do the countries of origin of both the Focal Company (FC) and supplier influence the customer purchasing behavior (CPu)?
>
> RQ2: Is customer perception of the FC sustainability linked to distance and perception of country sustainability?

Based on the literature regarding sustainable supply chain management, customer perceptions and country sustainability, nine hypotheses have been developed. Data have been gathered through four separate types of questionnaires. A total number of 129 valid responses were gathered. This paper is organized as follows: section 2 provides the literature review and hypotheses derived from the literature. Section 3 describes the methods, while section 4 presents the results, including reliability and validity issues. Section 5 discusses the results of this study in light of previous insights from the literature. Section 6 concludes this paper by providing managerial recommendations, as well as possible limitations of the study and potential pathways for further research.

Literature Review and Hypotheses

Sustainable Supply Chain Management

In the context of supply chain management (SCM), the business case to integrate sustainability and foster sustainable supply chains has been developed, since sustainability becomes a growing demand within global business settings (Quarshie, Salmi, & Leuschner, 2016). Different definitions and interpretations are available for Sustainable Supply Chain Management (SSCM), ranging from a narrow focus towards environmental issues (also referred to as Green Supply Chain Management, GSCM), to a holistic interpretation of economic, environmental, social and ethical aspects in the supply chain (Ahi & Searcy, 2013). One of the working definitions of SSCM, which is adopted in the context of this paper as

well, is: “The integration of sustainable development and supply chain management [in which] by merging these two concepts, environmental and social aspects along the supply chain have to be taken into account, thereby avoiding related problems, but also looking at more sustainable products and processes” (Seuring, 2008, 132). As a result of a systematic literature review, Seuring and Müller (2008) present a conceptual framework for SSCM, consisting of three elements: triggers for SSCM; supplier management for risks and performance; and SCM for sustainable products (Seuring & Müller, 2008). Another popular conceptualization of sustainability is the triple bottom line (Elkington, 1998), in which sustainability is about finding a balance between economic, environmental and social performance. A triple bottom line framework for SCM was provided by Carter and Rogers (2008), who state “we are not suggesting that organizations blithely undertake social and environmental goals relating to the supply chain”, thereby referring to the extra costs that these goals would bring to an organization (Carter & Rogers, 2008, 369).

Such interpretations, in which SSCM is reduced to the supremacy of financial and economic dimensions over environmental and social dimensions, is criticized by Pagell and Shevchenko (2014), who state that “the question of how to create truly sustainable supply chains remains unanswered” (Pagell & Shevchenko, 2014, 44). A ‘truly SSCM’ might then be defined as follows: “To be truly sustainable a supply chain would at worst do no net harm to natural or social systems while still producing a profit over an extended period of time; a truly sustainable supply chain could, customers willing, continue to do business forever” (Pagell & Wu, 2009, 38).

Traditionally, the economic dimension received more attention in business (e.g. Friedman, 1970), but as customers have emerged as a driving force, more attention should be paid to environmental and social issues. This approach is supported by Xie (2014) whose research only concentrates on these two areas, as well as Gualandris et al. (2014) who suggest that what really matters are a firm’s environmental and social performances. Both argue that customers are more interested in these two aspects and therefore, firms concentrating on them will see a positive impact on their overall sustainability performance.

Emotions may play a major role in sustainability scandals. The growing awareness of negative effects due to unsustainable behavior results in demand on firms to take responsibility. In the last few years many sustainability scandals linked to companies have been exposed. Well known cases include the Rana Plaza factory collapse which was linked to Primark (Butler, 2014), child labor at a factory for Nike products, as well as harmful ingredients in Mattel products (Gualandris et al., 2014). While in the past this was mainly communicated via TV and newspapers, today’s social networks and media spread information faster than ever and reach people all over the world (Khuntia, Sun, & Yim, 2016). This resulted in a demand for transparency along the entire supply chain, and increased attention towards the effects of individual processes on sustainability (McWilliams et al., 2016).

Shoring and sourcing strategies

The focus on sustainability shifts from the individual firm level to the entire supply chain. Different shoring and sourcing strategies have been developed throughout the years, each having a positive or negative effect on supply chain sustainability. One strategy is to wholly own the supply chain by the FC such that every link of the chain is located in spatial proximity to the other. When parts of the supply chain are moved to other countries but are still operated by the FC, this strategy is called offshoring (Bhalla, Sodhi, & Son, 2008). Whenever a service is purchased from a supply chain partner, it is no longer wholly owned by the FC and we talk about outsourcing (Ellram, Tate, & Billington, 2008). Outsourcing can

take place in the same country or may involve going abroad, which is then called offshore outsourcing. Reasons for offshoring are lower wages, extended working hours due to the presence in different time zones, or proximity to important resources (Bhalla et al., 2008). Offshore outsourcing causes negative environmental impacts, such as an increase in (global) carbon emissions (Gurtu et al., 2016), and agricultural land grab in impoverished regions (Oguamanam, 2015).

The increasing complexity of global networks and sourcing strategies are challenging companies to act sustainably. Production processes are often spread across continents and the supply chain partners are linked by the flow of information, material and capital (Seuring & Müller, 2008). Different factors influence the supply chain and leads to increased uncertainty, which needs to be understood and managed (Menhat et al., 2014), and global sourcing should be interpreted within the context of sustainability (Zeleny, 2007). Each process step has environmental and societal effects and often it is the FC which will be held responsible for these outcomes. This poses a challenge for the FC to manage the complete supply chain, including direct, second and third tier suppliers. Therefore, the company has to ensure that corporate sustainability is practiced internally and that these values are followed equally by their supply chain partners (Seuring & Müller, 2008).

Two more strategies gained popularity in recent years. Reshoring aims to bring the business back home, especially manufacturing. These initiatives are responses to the decreasing income gap between the West and its offshore locations and a growing supply chain complexity (Goodwill & Goodwill, 2012), as well as the result of economic crisis and customer demand for flexibility and improved cost performance (Tate, 2014). Similarly, nearshoring moves the business not fully home but closer to home, i.e. to a nearby country (Ashby, 2016). In order to ensure sustainability at the supplier, effective supplier management needs to be in place. Therefore, the reason to offshore in order to save costs has lost in importance while closer ties with the supplier, made possible by geographical proximity, have become a priority. However, the process of moving offices and people as well as creating new ties is costly. Different initiatives have been presented to encourage reshoring and local sourcing, such as a framework to 'right-shore' which considers the initial decision making process to offshore and then re-evaluates that decision (Joubioux and Vanpoucke, 2016), sustainability factors for reshoring (Ashby, 2016), and carbon footprint tax (Choi, 2013). Gualandris et al. (2014) compare firms with local businesses and firms with global businesses with regard to their sustainability strategies. They found that for local firms traditional supply management (SM) is a sufficient prerequisite for sustainable behavior. For global companies, in addition to SM, SSCM has to be introduced to show significant improvement in sustainability performance. They also claim that adopting global sourcing strategies does increase supply chain complexity but may at the same time push the company to introduce SM and SSCM more effectively and improve environmental and social performance.

Customer Demand and Perception

In the literature, different drivers to integrate sustainability are identified, such as compliance to laws and regulations. More and more however, customers demand sustainability and companies find ways to meet this demand, e.g. by analyzing and lowering product carbon footprints (Arıkan & Jammernegg, 2014). Attention towards sustainability can lead to an increase in sales and a growing customer base. This has resulted in companies reporting on their Corporate Social Responsibility (CSR) (Milne & Gray, 2013). Customers and clients are important drivers behind these reports (EY, 2014). Also, the attention to supply chain

scandals leads to increasing customer demand toward sustainability and transparency (Gualandris et al., 2014).

An important aspect of customer demand is the perception of the focal company and its supply chain. Irresponsible behavior of one SC partner can have a negative impact on the reputation of the remaining partners. Following Molet et al. (2013) an individual will be evaluated negatively when associated with someone else who has a bad reputation. This is called 'association by guilt' and can be compared to a supply chain contagion (Molet et al., 2013). Referring back to the differentiation between offshoring and outsourcing, this concept indicates that outsourcing a sustainably weak part does not necessarily increase the reputation of the FC's sustainability. It will still be associated with the FC's supply chain, and thus, whenever a problem is identified at a supplier, this can negatively impact the FC, too. The opposite, association by honor or the 'halo effect', is also possible. Products sold by companies that engage in social initiatives will automatically be perceived as more valuable or sustainable even though the product itself might have no link to any of the initiatives (Chernev & Blair, 2015). Often, this is the main reason for businesses to engage in CSR. Further, people tend to project their own traits onto others, which is called 'Spontaneous Trait Transference' (Molet et al., 2013). This could mean that consumers who act sustainably might expect firms to act the same.

For this study, it is important to consider whether the transference of traits differs with distance. According to Lii, Wu, & Ding (2013), the closer a customer is to a company, whether considering spatial or social distance, the stronger is the effect that CSP may have on customer perception. Xie (2014), on the other hand, suggests that consumers have adopted a globalized perception. CSR initiatives to them are global initiatives and therefore not necessarily linked to an individual country. In view of these opposing positions, spatial distance between a customer and a company will be studied in more detail in a separate section.

Homburg, Stierl, & Bornemann (2013) suggest that business oriented CSR increases trust in the company while philanthropic CSR supports the consumer's identification with the company. Accordingly, Xie (2014) explains that satisfaction, trust and identification are important values that contribute to strong customer support. If the relationship between company and customer scores low on these three values there is a greater chance of the customer boycotting the brand in case of a scandal (Sen & Bhattacharya, 2001) or switching to a different brand (Friedl & Wagner, 2012). Therefore, we propose that customers identify more easily with companies of low spatial distance and, thus, are more loyal to those than to foreign companies of high distance. Thus, it is very valuable for companies to know what is important to their customers and which initiatives can evoke the greatest emotions and identification with the cause. A report by Morgan Stanley (2015) has also taken a look at whether age or gender influence personal evaluation. It shows that Millennials, people born around 1980-1999, and especially female customers are interested in sustainability.

The strong focus on the link between customer and company has led to the question whether customers are purely interested in the point of sale, and thus, only the sustainability of the FC. This would indicate that consumers take a great interest in CSP of businesses with low spatial distance but are likely to ignore the rest of the supply chain. Further, consumers might show less interest in sustainability when there is high spatial distance or intuitively evaluate these companies as less sustainable. Therefore, the next section extends the discussion about customer-company by 'country' and suggests that customer perception of sustainability can be influenced on all three levels.

Country Sustainability

Country sustainability indices, like the one for companies, vary in size as well as in indicators. Some of them only measure the ecological footprint or, like the Human Development Index (Neumayer, 2001), mostly social and economic sustainability. One index measuring all three indicators of the TBL is the Sustainable Society Index (SSI). The SSI analyzes 151 countries and includes 21 indicators in three categories: economic wellbeing (5), human wellbeing (7) and environmental wellbeing (9) (SSF, 2015). Neumayer (2001) suggests there is no direct relationship between environmental and social factors. The Sustainable Society Foundation (SSF), however, has found at least some negative correlation in their SSI and therefore decided to publish separate rankings for each indicator instead of an overall sustainability index (SSF, 2015). For instance, while Mozambique as well as the Central African Republic score very low on human wellbeing, they can both be found in the top 10 of the environmental index.

The linkage between a country's national culture and corporate sustainability efforts has been analyzed by Vachon (2010), in which corporate sustainability is related to a nation's degree of individualism and uncertainty avoidance. Lopez and Balabanis (2015) have found support for their hypothesis that consumers' perception of a country's industry and corporate landscape impact their perception of that country's sustainability. Therefore, we take a closer look at a country's effects on consumer opinion about company sustainability. The question is, whether the sustainability of individual sourcing countries and the FC's country of origin influence the consumer's perception of the brand's sustainability.

Table 1. Hypotheses

Hypothesis	Derived from
*H*1: The customer's perception of a company's sustainability is expected to have a direct impact on the customer's willingness to continue buying from the focal company	(Sen & Bhattacharya, 2001; Friedl & Wagner, 2012)
*H*2: The customer's perception of a company's sustainability is expected to have a direct impact on the customer's willingness to pay a price premium for sustainable products from the focal company	(Lii et al., 2013; Xie, 2014)
*H*3: The customer's interest in sustainability has a moderating effect on the link between the customer's perception of a company's sustainability and the customer's willingness to continue buying from the focal company	(Molet et al., 2012; Chernev & Blair, 2015)
*H*4: The customer's interest in sustainability has a moderating effect on the link between the customer's perception of a company's sustainability and the customer's willingness to pay a price premium for sustainable products from the focal company	(Molet et al., 2012; Chernev & Blair, 2015)
*H*5: Females are more interested in sustainability than males	(Morgan Stanley, 2015)
*H*6: Spatial distance is expected to have a direct impact on a customer's perception of a company's sustainability	(Lii et al., 2013; Xie, 2014)
*H*7: Low spatial distance of the supplier's country of origin is expected to have a direct positive impact on a customer's perception of a company's sustainability	(Lii et al., 2013; Xie, 2014)
*H*8: Low spatial distance of the focal company's country of origin is expected to have a direct positive impact on a customer's perception of a company's sustainability	(Lii et al., 2013; Xie, 2014)

*H*9: The customer's perception of a country's sustainability is expected to have an impact on the customer's perception of the company's sustainability, when associated with that country	(Lopez & Balabanis, 2015)

Hypotheses

In line with the literature on SSCM, customer perception and country sustainability, nine hypotheses are formulated. Table 1 presents the hypotheses, as well as the main sources from which they are derived.

Methods

Research setting, data collection and survey instrument design

Four different types of questionnaires were created to test the hypotheses. The surveys contained an identical case and identical questions but the countries of origin of the companies differed across the survey types. The surveys were aimed at respondents from Western Europe to keep a similar spatial distance between the respondent and the FC and supplier countries mentioned in the case. The surveys were created and shared via the online platform 'Free Online Surveys', and shared via social media. Due to a snowball effect, this also yielded many responses from non-European countries. After deleting invalid replies, 129 responses remained, having received >30 replies for each of the four survey groups. Table 2 provides the demographics. It is notable that most respondents were female and between 20 and 40 years old.

The case introduced in the surveys focused on unsustainable poultry production, because it is a pressing issue locally (Germany), as well as abroad (Indonesia). This facilitated the decision to test the link between local/foreign countries. The case presents a negative situation caused by the supplier of the FC. It intends to find out whether this negative situation will be projected onto the FC by the respondents. As the company is fictitious and presented negatively, the answer is expected to be influenced through 'association by guilt' (Molet et al., 2012; Chernev & Blair, 2015). The FC in the survey cases is either Japanese or Spanish, while the supplier is located in Germany or Indonesia. Thus, it resulted in a total of four combinations (Table 4) ranging from very low distance (2) to very high distance (3).

Table 2. Descriptives

Category	**(1)**	**(2)**	**(3)**	**(4)**
#Respondents	34	32	31	32
Male	38.2%	40.6%	35.5%	50%
Female	61.8%	59.4%	64.5%	50%
Average Age	24	24	24	36
German	64.7%	78.1%	90.3%	84.4%
Dutch	23.5%	18.8%	3.2%	3.1%
French	2.9%	3.1%	3.2%	0%
British	5.9%	0%	3.2%	9.4%
Irish	2.9%	0%	0%	0%
Scottish	0%	0%	0%	3.1%

Measurements

Country attributes (CO) consists of spatial distance between respondent and country as well as respondent perception of country sustainability. Research suggests that people may show stronger support for local than foreign companies but this hypothesis is not supported (Xie, 2014). One reason could be that perception of CSR is not directly dependent on the country of origin. Rather, it might be influenced by the perceived honesty of intentions and the trust of customers in a company. Trust however may vary due to the countries in which CSR is implemented. One possible reason is that trait transference of good faith and trustworthiness might be harder to apply the more foreign and unknown a company or country is.

Table 3. Survey Constructs

Construct	Reference
Spatial Distance	Lii et al., 2013; Xie, 2014
CP	Molet et al., 2012; Chernev & Blair, 2015
CPu	Lii et al., 2013; Xie, 2014; Molet et al., 2012; Chernev & Blair, 2015
CI	Morgan Stanley, 2015
Case	Indonesia: Brienen et al., 2014 | Germany: Klawitter, 2011

Table 3 provides an overview of survey constructs. CPu refers to customer purchasing behavior as a (possible) reaction to the case. It is analyzed whether the perception of the company, which is hypothesized to be influenced by spatial distance and the personal assessment of country sustainability, has an impact on the customer's buying behavior (Molet et al., 2012; Chernev & Blair, 2015). It considers whether customers would simply continue to buy from this brand (CPu1) or would even pay a price premium (PP) if the brand would sell sustainable produce (CPu2) (Lii et al., 2013; Xie, 2014). In addition, a closer look is taken at the mediating role that Customer Interest in Sustainability (CI) might play. Here, three items refer to the case and three to general preferences towards local vs foreign products. Furthermore, gender related differences in answers to CI will be analyzed.

Analysis

The analysis of the hypotheses is done with IBM's SPSS software. Normality is assumed as each survey version received >30 responses. First, the model is tested for reliability by calculating each construct's Cronbach alpha (Pallant, 2013). In some cases inconsistency was found, therefore it was decided to reduce the number of items or split the construct. Next, a principal component analysis (PCA) has been performed to test construct validity (Pallant, 2013), results showed whether the combination of items is correct or whether additional factors can be identified. Overall, the results are satisfactory. For the hypothesis testing, items are first tested for correlation. This aims at testing possible relationship between the CPu items and whether the earlier decision to split and test them separately was correct. For $H1$ and $H2$ a regression tested whether CP is a predictor for CPu. A simple linear regression is used as there was only one predictor variable (CP) (Field, 2009). Next, a partial correlation test calculates the moderating effect of CI on the link between CP and CPu ($H3$; $H4$). For partial correlation variables need to be continuous, therefore, this study would violate this assumption. However, Bortz, Lienert and Boehnke (2008) suggest that satisfactory results can still be achieved. For $H5$ the difference between male and female responses to CI is compared. As there are only two groups, a t-test is chosen (Pallant, 2013). For $H6$-$H8$ four independent groups are compared, and a one-way between groups ANOVA helps to test for

significant differences. Finally, the impact of customer perception of country sustainability on his/her perception of the company's sustainability (*H*9) is tested with a linear regression. The following sections explain the procedure and the results in more detail.

Reliability and Validity

Every construct is tested for reliability by checking its Cronbach alpha, a valid alpha being ≥0.7. In some constructs this is not the case and, thus, the Inter-Item Correlation Matrix has to be checked for low correlation values. Items with values <0.3 are taken out of the group. Another way to detect an unfit item is to look at the 'Alpha if Item Deleted' table to see the impact of each item when removed from the scale. Table 4 shows the final Cronbach alphas for the 'Customer Interest in Sustainability' (CI) scale. The 'Customer Perception of Company Sustainability' (CP) scale was reduced to one item; "company XY is a sustainable company", and thus no reliability check is necessary. 'Customer Purchasing Behavior' (CPu) scores a Cronbach alpha <0.7 for every country combination and therefore, it is reduced and split into two items testing the effect of company perception on customer purchasing decisions separately (CPu1; CPu2). 'Customer Perception of Country Sustainability', part of CO, only achieves a Cronbach Alpha >0.7 in (1). It is decided to test the effect of FC country and supplier country one by one, thereby enabling a comparison between the two items.

A PCA is performed in order to test whether the current constructs show more underlying linear combinations than assumed. There are two conditions to see whether such factorial analysis is appropriate: the Kaiser-Meyer-Olkin value, which should exceed 0.6 (Kaiser, 1974), and the Bartlett's Test of Sphericity (Bartlett, 1954), which reports statistical significance. The CI scores significant results for every country combination and, therefore, is analyzed for factors. Except for combination (3), which shows two possible components, the scree test and parallel analysis result in only one component with a total initial Eigenvalue >1. This supports the strength of the scale and it is decided to keep one component for (3) too, to ensure comparability between the groups. Therefore, the grouping proves to be appropriate. On this basis, the next section describes the results of the hypothesis testing.

Table 4. CI Scale, Reliability Test

Country Combination	Cronbach Alpha
Japan_ Germany (1)	0.816
Spain_ Germany (2)	0.878
Japan_ Indonesia (3)	0.799
Spain_ Indonesia (4)	0.9

Results

The hypotheses are tested within groups. Only for the spatial distance item, a one-way ANOVA is performed in a master file containing all responses to test the variance between groups. First, correlation between the two items of the CPu scale is calculated again, to see whether the decision to test them separately is appropriate. No significant correlation is present. Thus, the decision is supported.

Next, a linear regression helps to test *H*1 and *H*2. *H*1 is supported for groups (1), (2) and (4). For group (3), the results only show marginal significance. The tests show no support for *H*2 throughout groups (1)-(3) but do show marginal significance for (4). Therefore, it can be concluded that the perception of a company's sustainability is a prerequisite to the decision on

whether to continue buying from that firm (CP-CPu1). However, there is no or very little evidence that it is a prerequisite to the decision to pay a price premium for sustainable products (CP-CPu2).

Table 5. ***significant at p<0.01; **significant at p<0.05; *significant at p<0.1

Group	CPu item	R	R2	B (Constant)	B (Independent Variable)
(1)Japan_Germany	CPu1	.347	.120	1.263	.370**
	CPu2	.065	.004	3.754	-.099
(2)Spain_Germany	CPu1	.792	.628	.684	.693***
	CPu2	.156	.024	3.649	-.158
(3)Japan_Indonesia	CPu1	.326	.106	1.250	.375*
	CPu2	.013	.000	3.553	.018
(4)Spain_Indonesia	CPu1	.606	.367	.630	.699***
	CPu2	.331	.110	4.417	-.454*

Partial correlation is used to explore the relationship between perceived company sustainability and CPu, while controlling for scores on the CI scale (*H*3-*H*4). There are weak, partial correlation coefficients for (1) and (3) and strong partial correlation coefficients for (2) and (4) controlling for CI on CPu1. For CPu2 only results for (4) are calculated as the other groups showed no link between CP and CPu2 in the first place. Here, the partial correlation coefficients are also weak. An inspection of the zero order correlation suggests that controlling for CI has very little effect on the strength of the relationship of CP-CPu. Thus, *H*3 and *H*4 do not find support. A t-test helped to examine whether there is a significant difference in CI depending on gender (*H*5). Only 21% of all items show a significant difference (<0.5): In (1), no significant results are found, while for (2) three items show significant values. For (3) and (4) each group shows a significant difference for one item. The majority shows no significant difference in responses and thus, *H*5 is not supported.

Table 6. ANOVA Results

‘Company X is a sustainable company’					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	8,945	3	2,982	4,301	,006
Within Groups	86,652	125	,693		
Total	95,597	128			

For *H*6-*H*8, a one-way between-groups analysis of variance is conducted to see if the responses to ‘company XY is a sustainable company’ differ (Table 6). There is a significant difference at p < .01 between the four groups: F(3, 125) =4.3,p =.006. The result supports *H*6. The post-hoc test shows that the significant differences are between the groups Spain_Germany and Japan_Indonesia (.014), as well as Spain_Germany and Spain_ Indonesia (.011). Looking at the mean plots, it is interesting that (2) has the highest mean score (M: (2)=2.13; (1)=1.68; (3)=1.48; (4)=1.47), meaning that the group with the lowest spatial distance, for FC as well as supplier, receives on average better results for the perception of the company’s sustainability than combinations with higher distance, which supports *H*7 and *H*8. Additionally, the partial eta squared effect size is calculated to show how strongly the independent variable can explain the variance of the dependent variable. According to Cohen (1988) there is a small effect at .01, a medium effect at .06 and a large effect at .14. This analysis shows an effect of .0936 or 9%, resulting in a medium to large effect.

Finally, a linear regression helps to test *H*9. The country of the supplier and the FC are tested separately to detect possible differences. None of the *R*2 values explain more than 9% of the variance in the models. Looking at the output summary in Table 7, no significant results are found and, therefore, *H*9 cannot be supported.

Table 7. *significant at p<0.05

Group	Country of _	R	R2	B (Constant)	B (Independent Variable)
1	FC	.053	.003	1.587	.036
	Supplier	.189	.036	1.149	.146
2	FC	.3	.09	.903	.444
	Supplier	.199	.039	.913	.337
3	FC	.183	.034	1.016	.148
	Supplier	.132	.017	1.200	.133
4	FC	.186	.035	1.939	(-).186
	Supplier	.004	.000	1.462	.003

Discussion

This study puts forward nine hypotheses, out of which three can be supported. Two can only be supported for some groups and four do not show significant results (table 8). *H*1 examines a possible impact of the consumer's assessment of a company's sustainability on his/her willingness to continue buying from that firm. A significant impact is found for all groups except (3), which is the combination of highest distances for FC and supplier, Japan_Indonesia. Here, only marginal support can be found. *H*2 looks at a possible impact of the consumer's assessment of a company's sustainability on his/her willingness to pay a premium for sustainable products. Only (4), Spain_Indonesia, receives marginal support while the null hypothesis cannot be rejected for the other groups. These results support the theory that consumers show stronger loyalty for companies of lower distance. It might be due to a lack of trust for foreign businesses and products as well as the inability to identify with the issues (Homburg et al., 2013; Lii et al., 2013). However, one needs to differentiate between the two CPu items. On average, people are not willing to continue buying from the company but would consider paying a PP if the company started selling sustainable products. This shows there is a general interest in and activism for sustainability which is also supported by the motivation to share the information about unsustainable production with friends and family. The answers also support the hypothesis that customers are more tolerant towards local than foreign countries and companies. When asked whether they prefer local over foreign products, respondents agree on average. The same is true for trusting local products more than foreign ones and considering local products to be more sustainable.

Customers' interest in sustainability seems to have no moderating effect on the relationship between their company perception and the willingness to continue buying from that brand (*H*3). This seems to be contradictory to the results of Sen and Bhattacharya (2001) who claim that customer interest in a topic strengthens their support for a CSR initiative, thus showing an impact by CI. A closer look at the mean answers shows that respondents of group (3) were the most indifferent to CI items (ranging from 3.71-3.97). This seems to indicate that customers care less about countries of high spatial distance. However, responses to CI in groups (1), (2) and (4) do not vary greatly and, therefore, this interpretation should be tested again in a more detailed research about customer interest in sustainability.

To summarize the first four hypotheses, perceived company sustainability has a larger impact on the decision to continue buying products from that firm than on the willingness to pay a premium for more sustainable products from the same company. This can be due to the fact that people who rate company X as very (un-)sustainable probably will (not) continue buying from that firm. The lack of a significant proof if CP has an impact on PP is a result of the variance in responses. On the one hand, people that have rated the firm as unsustainable and are not willing to pay a PP might not want to support this company at all, while others might give it a chance and pay a PP given that the company starts offering sustainable products. On the other hand, customers giving responses that score higher on CP are probably satisfied with the current situation and would not see the necessity for more sustainability, thus, not willing to pay more. The inconsistency highlights once again that people have very different understandings of sustainability. However, respondents show on average the same interest in sustainability across all groups, therefore, CI does not seem to have an impact on CP–CPu. *H*5 aims at finding out whether gender might also influence CI and, therefore, the link between CP and CPu. The results cannot support this hypothesis. Looking at the answers it is also interesting that in eight cases (33.3%) female respondents show less interest than male respondents, contradicting the study by Morgan Stanley (2015). Therefore, gender can be excluded as a possible influence on CI in this study.

Table 8. Hypothesis Results

Hypothesis	(1)	(2)	(3)	(4)	Tested between groups
H1	Yes	Yes	Yes(marginal)	Yes	
H2	No	No	No	Yes(marginal)	
H3	No	No	No	No	
H4	No	No	No	No	
H5	No	No	No	No	
H6					Yes
H7					Yes
H8					Yes
H9	No	No	No	No	

Lastly, it is tested whether responses to CP significantly differ between the groups depending on the country combination to strengthen the suggested reasons for varying results in *H*1-*H*2. On the one hand, this is implicitly tested due to the four separate groups. On the other hand, respondents were directly asked to assess the countries according to their sustainability. The first part (*H*6-*H*8) receives significant results and, thus, it can be concluded that the countries of the FC and the supplier do influence the consumer perception of the FC on a subliminal level. Especially in the case of low distance to both parties (2), a significant positive impact can be noted. Again, this supports the assumption that consumers trust more or feel more loyal to the FC, the closer its supply chain is (Lii et al., 2013). However, this is not necessarily because consumers think that close countries are more sustainable than distant ones. *H*9 does not find support in this analysis.

Conclusion

Sustainability has been widely discussed in the literature. Consumers increasingly care about sustainability and demand more transparency about the way products have been sourced. This study aims at adding the impact of country sustainability to the common company/customer effect models. Results point out that it actually does matter to the customer where FC and

supplier are located. It highlights that in a supply chain contagion not only can the SC partners affect each other but also the countries of origin can transfer their characteristics on the firms.

Managerial implications can be made for the supply chain as well as the marketing side. When a supply chain scandal occurs, customers would not continue buying from the same company and would feel compelled to raise awareness. Furthermore, they trust and prefer local over foreign products, considering them to be more sustainable. In consideration of the recent debate about reshoring, these findings play an important role. Apart from the closing cost gap between Western and Eastern countries, an important incentive to re-locate is the growing demand for local products. This study suggests that being local and sustainable is closely connected in the consumers' perceptions and they are willing to acknowledge these efforts by paying a higher price. For marketing purposes, the interest in sustainability seems to be lowest when spatial distance is high, so it might be worthwhile to highlight local sustainability measures. Customers' decision to purchase products depends not only on the perceived sustainability but also on the associated countries in the supply chain. A full reshoring of the supply chain and end-to-end sustainability might not be necessary. It is important to keep the core business local to promote trust and identification. Sustainability measures may also have the greatest effect on customer support if they aim at local problems. However, as Lii et al.(2013) already warned, customers need to trust the firm and identify with the cause in order to support it, and to pay a premium. This also leads to specific recommendations for policy makers, as they should carefully identify policies to encourage re- or near-shoring, and support local competitiveness.

This study also has some limitations, leading to specific recommendations for further research. The sample size is one such limitation. Each group consisted of >30 participants but larger samples are more reliable. Further, the majority of respondents are Millennials. This is supported by Morgan Stanley (2015) as they claim that this age group has the greatest interest in sustainability. However, it can also be seen as a bias and, therefore, in the future a greater variety in the respondents' age should be considered. Another limitation is the case. While the pilot test, with and without case, did not show any significant differences between groups, the answers might differ depending on the content of the case. The topic of poultry production was chosen due to the presence in countries close to and distant from the respondents. As public commitment in these areas is quite new, this case might also have led to more emotional answers to the survey. Therefore, it would be interesting to compare reactions to different cases, including larger variety of products (e.g. Clothing: Osibanjo & Nnorom, 2007; Electronics: Freise & Seuring, 2015).

Companies need to reconsider their supplier ties and their sustainability measures to avoid suffering from association by guilt. The perceived sustainability of the country of origin of the FC and its suppliers seem to influence customers' perceptions of the FC itself. While customers tend to perceive countries of low spatial distance as more sustainable, they also expect them to act more sustainably, and show greater interest in local initiatives.

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IMPLEMENTING VALUE-BASED APPROACH IN SERVICE PURCHASING: IN-DEPTH CASE STUDY FINDINGS

Mervi Vuori

Lappeenranta University of Technology, School of Business and Management, PL 20, FI-53851 Lappeenranta, Tel: + 358 50 526 72 96, Fax: +358 562 12 644, mervi.vuori@lut.fi

Joona Keränen

Lappeenranta University of Technology, School of Business and Management, PL 20, FI-53851 Lappeenranta, Tel: + 358 40 482 70 81, Fax: +358 562 12 644, joona.keranen@lut.fi

Joona Karjula

Aalto University, Department of Industrial Engineering and Management, Otaniementie 17, FI-02150 Espoo, Tel: +358 440 330 475, joona.karjula@aalto.fi

Abstract

Research on value-based approach in purchasing and supply management is scant thus pointing to need for more knowledge in this domain. This paper reports the findings of in-depth dyadic case study regarding the implementation of value-based approach between a manufacturer and their service supplier in outsourced service context. The findings highlight the various challenges that were experienced by the buyer and the service provider as the companies engaged in selling and purchasing engineering services as a value-added service package. The findings contribute to the evolving discussion on value-based approach in purchasing and supply management.

Keywords: Value-based purchasing, service purchasing, dyadic case study

Introduction

The role of purchasing and supply management has become increasingly strategic in improving cost effectiveness, value generation and ultimately, the competitive advantage of a company (Tchokogué, Nollet and Robineau, 2017). A key area where purchasing can contribute to improved performance outcomes and company value creation is service outsourcing (Ellram and Tate, 2015). However, recent research indicates that most of the purchasing decisions in this domain are driven by short-term price savings and cost reductions with less consideration for longer-term effectiveness, innovation or business improvements (Meehan, Menzies and Michaelides, 2017; Ellram, Tate and Billington, 2008). The concept of value-based purchasing refers to collaborative efforts between the buyer and the supplier whereby the intention is to align the supplier's resources, products and services so that they best meet the outcome-based goals of the buyer (Meehan et al., 2017). While previous research on value-based business strategies has almost exclusively focused on selling approaches i.e. the supplier perspective (e.g., Terho, Haas, Eggert and Ulaga, 2012; Keränen and Jalkala, 2014), research on value-based approaches in purchasing is scant and only emerging (Meehan et al., 2017; Pinnington,

Meehan and Scanlon, 2016). Furthermore, despite the notion that the implementation of value-based approach requires intense collaboration between the buyer and the supplier (Hallikas, Immonen, Pynnönen and Mikkonen, 2014) research in dyadic settings is virtually missing. In order to contribute to these observed knowledge gaps, our purpose is to explore the implementation of value-based approach in the context of purchasing professional services from a dyadic perspective. The research question reads: *What challenges relate to selling and purchasing engineering services as value-based service packages?* The findings contribute to the evolving discussion on adopting a value-based approach in purchasing and supply management (Tchokogué et al., 2017; Meehan et al., 2017).

Literature background

Traditionally, sourcing has been regarded as a tactical function, yet today it is acknowledged that purchasing is increasingly strategic that can contribute to overall company competitiveness in various ways (Tchokogué et al., 2017. Inherent to the tactical orientation, the emphasis in purchasing and supply management has traditionally been on cost reduction. Yet, it has been suggested that the mere cost focus is not adequate, but it should be complemented with initiatives that aim at company capability improvement through outsourcing non-core functions and activities (Gottfredsson, Puryear and Phillips, 2005). The importance of resources residing outside company boundaries has thus grown, and companies are increasingly faced with the task of managing their external resources, finding best potential partners, combining internal and external resources together, and utilizing external resources in effective ways (Tanskanen, Ahola, Aminoff, Bragge, Kaipia and Kauppi, 2017).

As the strategic opportunities related to purchasing and managing external resources are becoming increasingly acknowledged, there is a need for taking a more holistic view to purchasing and supply management and related opportunities. “Value-focused supply”, as conceptualized by Monzcka, Blascovich, Parker and Slaight (2011) goes beyond mere cost reduction and competitive bidding strategies by describing an approach that aims to secure current value as well as create new value for a company. Consequently, the approach acknowledges several strategies that the buying company can implement with suppliers in order to increase revenues and manage company tangibles and intangibles in efficient ways (ibid). Yet as noted by the authors, taking a value-focused perspective into purchasing and supply management requires considerable changes from the buying organization. These changes relate to introducing a new philosophy regarding supply, implementing new goals and metrics, taking new supply management approaches into use and establishing new organizational teams, both internal and external (Monzcka et al., 2011). Eltantawy and Giunipero (2014) also address the need for new mindset and philosophy in purchasing and supply management organizations and top management that would enable purchasing to be regarded as an increasingly strategic function that creates value through working with suppliers. According to the authors, the need for a new orientation is accentuated by the fact that the emphasis in many companies has shifted from the exchange of tangibles towards exchanging skills, processes and knowledge as suggested by proponents of the service-dominant logic (SDL) (see Lusch, 2011; Lusch, Vargo and O’brien (2007). The implication to purchasing or more extensively, to supply chain management is that instead of viewing the supplier as mere provider of outputs (as per the traditional goods-oriented logic), the supplier is seen as a provider of inputs or services, that the buyer then integrates with its own activities and processes (Lusch, 2011). The service dominant logic is closely associated with outcome-based supply chain strategies, performance-based logistics and contracts (Wittmann, Nowicki, Pohlen and Randall, 2014) as well as outcome-based contracting (Ng and Nudurupati, 2010).

Based on these views, it appears that adopting a value-based approach into purchasing is becoming increasingly relevant. The concept of value-based purchasing refers to collaborative efforts between the buyer and the supplier whereby the intention is to align the supplier's resources, products and services so that they best meet the outcome-based goals of the buyer (Meehan et al., 2017). Nevertheless, research on the adoption of the value-based approach in purchasing and supply management is scarce, and studies related to this topic are only beginning to emerge (Meehan, Menzies and Michaelides, 2017; Immonen, Hallikas and Pynnönen, 2016; Hallikas, Immonen, Pynnönen and Mikkonen, 2014). Adopting a value perspective to purchasing and supply management may also prove a challenging task in practise. In the domain of professional services for example, the study by Ellram, Tate and Billington, (2008) found that service outsourcing decisions are dominantly driven by short-term price savings, with only sparse consideration for potential quality and process improvements i.e. longer-term opportunities that exist outside the price savings - cost reduction realm. Indeed, compared with the conventional purchasing approaches that centre on price savings and / or cost reduction, the value-based approach requires taking a long-term perspective into the costs and benefits of the purchased product or service over its lifecycle (Meehan et al., 2017). Additionally, the buyer needs to think in broader terms with respect to the purchased services and products and focus on the outcome instead of the input (ibid.; Anderson and Wynstra, 2010). In a recent study, Hallikas et al., (2014) raise the issue of purchasing service bundles in comparison to separate services whereby the former means that the buyer has to justify higher prices with expected time and cost savings that take place in the future. This may prove difficult given that the cost reductions still form the main driver for purchasing professionals (Eltantawy, Giunipero and Fox, 2009).

Value-based selling approaches from the supplier or service provider perspective has received plenty of scholarly attention (see Terho, Haas, Eggert and Ulaga, 2012; Töytäri and Rajala, 2015). Here, the value-based approach can be related to solutions selling whereby solutions are regarded as integrated combinations of products/and or services, which are customized to the buyer's needs and aim to produce desired outcomes and help to solve the customer's problem (Miller, Hope, Eisenstat, Foote and Galbraith 2002; Stremersch, Wuyts and Frambach, 2001). From the solution provider i.e. supplier perspective, the key idea is to pinpoint and identify areas in the customer's i.e. buyer's processes where the solution offering can potentially create value, and where the supplier can help the customer to improve its performance on long-term (Keränen & Jalkala, 2014). Yet as noted by Töllner, Blut and Holzmüller (2011), most of this research has been conducted from the seller i.e. supplier perspective, leaving the buyer or customer side to lesser focus (the authors point Tuli, Kohli and Bharadwaj 2007 as an exception). This is surprising given that the success of the offered solution depends ultimately on the buyer (Töllner et al., 2011). In their review of solutions selling literature, Nordin and Kowalkowski (2010) observe that the driver for purchasing solutions is not always clear, as this can relate to both the need to "getting more benefits for the same money" or simply to total cost reduction. Given the relatively sparse attention to implementation of the value-based approach in purchasing and supply management literature and the emphasis on the supplier perspective in solution selling literature, it appears that enhanced knowledge is needed on the adoption of the value-based approach from both the buyer as well as from the supplier perspectives. This paper aims to contribute to this discussion by studying challenges that relate to selling and purchasing engineering services as value-based service packages.

Research design and method

As the study focuses on complex inter-organisational issues, qualitative and exploratory single case study research design was adopted (Yin, 2009) due to its strength in revealing insights into the individual and organizational activities, perceptions, and decisions. Theoretical and

purposeful sampling logic (Patton, 2015) was used to select the case companies comprising a manufacturing company and their key service provider of engineering services. The empirical context illustrates a case, where the buyer outsourced engineering design services to a service provider, who in turn introduced value-based elements into the relationship with the aim of becoming a value-oriented supply partner that increasingly provides solutions and service packages. The project thus provided a unique context for investigating the implementation of value-based approach on both sides of the dyad. The service provider is a multi-national company that provides industrial engineering services, yet recently the company introduced a new business strategy with emphasis on two issues in particular: gaining growth through their key customers, and selling service solutions. The buyer represents a company operating in processing industry that provides technology solutions as well as services to its customers. Together, the companies share a long-standing business relationship.

The empirical data comprises 15 semi-structured interviews of which seven were conducted with the buyer and eight with the supplier. The length of the interviews ranged from 60 to 120 minutes. Two researchers were involved in data collection that took place between April 2017 and February 2018. Interview data were supplemented with information from the company websites, commercial material, memos and observations from multiple meetings with the companies. By the time of writing this paper, 13 interviews were transcribed by using external transcription service. Data analysis followed open and thematic coding process to identify major factors that influenced individual and organization decisions and perceptions (Miles, Huberman and Saldaña, 2014). The analysis was conducted by using Atlas.TI qualitative data analysis software. Based on the initial categorization, more detailed excel-matrices with main categories, sub-categories and illustrative quotes were crafted.

Findings

Traditionally, the service provider has been providing CV's (pointing to curriculum vitae of individual persons), meaning that emphasis in sales has related to providing individual engineering resources to their customers. In general, this has had both negative as well as positive consequences. On the positive side, providing resources to key customer's projects allows the service provider to work very closely with the key customers and be an inherent part of their daily operations and the customer organization. However, on the negative side, providing resources somewhat limits the service provider's potential to offer and deliver larger entities, such as outsources projects, or full service solutions. Providing resources is based on hourly fee which are negotiated annually by the case companies. The service provider's resources are tied into the customer's projects for up to several months and are thus not available nor transferrable to other projects during this time. The new strategic focus of selling service solutions aims to reduce the emphasis on traditional "CV-exchange" and re-establish the service provider's role as a partner for value creation that manages and delivers outsourced projects on behalf of their customers. "*The business can't be only about selling hours, but we need to have certain areas which we want to develop and these we need to agree upon and decide on together with our customer" (VP, Service provider).*

In the investigated project, the service provider took an active role in promoting themselves as a provider of service packages i.e. provider of larger service entities instead of hours, or individual resources. In the investigated project, the buyer and the supplier agreed on the provision and delivery of a service package at a fixed fee. Compared with the conventional way of purchasing engineering services, which had been dominantly input-based i.e. the buyer purchased a certain amount of hours that were charged by hourly fee, purchasing a service package and agreeing on a fixed fee reimbursement indicates a step towards a value-based approach in the mutual exchange. With regard to the investigated project, the companies shared

understanding that key criteria with respect to the purchased service package comprised quality, in-time delivery and cost efficiency. In selling the service package however, the service provider offered the package at a considerably lower price compared to competitors. This was a deliberate strategy to get the business and to obtain a customer reference in order to establish themselves as a provider of larger service entities. The buyer acknowledged this, and since the buyer was under price-pressure from their end-customer, the offer was chosen.

In the following chapters, the findings concerning challenges related to selling and purchasing engineering services as value-based service packages are reported.

Improving customer cost-efficiency was emphasized strongly by the service provider and used as a key sales argument for the service package. The strategy for improving customer's cost efficiency through a more extensive service package was linked to the service provider's offices in China and the ability to divide work and engineering tasks internally between different locations. For the buyer, this showed as an opportunity to improve their cost efficiency and reduce design-related costs, which they considered as an important value element: "*It's not about the low cost but about the best cost through which value comes into picture. Here, it's is not only the cheapest price that is sought after, but thinking in terms of price and used hours"(Dpt manager, Buyer).* Benefits related to using resources in best-cost-country are in general acknowledged in the buyer organization: *"It is savings that we are after, and this is why I define at the beginning of the year, how large a share (or total engineering hours) should be done in a best-cost-country" (Dpt manager, Buyer).* These benefits are similarly seen in the service provider side, who has been developing work productivity through their Chinese resources. "*Through our best-cost-country operations we can bring (our customers) considerably better cost efficiency compared with performing the work only in Finland" (VP, Service provider).* Yet, the service provider acknowledged a need to truly show and prove the benefit to the customer: *"It is an issue of how many hours are used…that we are able to use less hours compared to what (the customer) thinks"(Dpt manager, Service provider. "We need to be able to show (the customer) how cost efficient we are."(VP, Service provider).*

The potential value through reduction in design costs appeared evident and lucrative for the buyer. Yet, using the supplier's best-cost-country resources for engineering services proved to be a somewhat controversial issue for the buyer. Using Chinese engineering resources was seen to create a risk that related to fears of losing intellectual property and receiving potentially poor quality services. Utilizing BCC was also influenced by an internal mind-set that fed reluctance to purchase engineering service from BCC as noted by Department Manager at the Buyer: "*People are reluctant to purchase (from China) because they fear poor quality or losing our IPRs" The biggest hurdle (to utilizing BCC resources) are in the people's heads. This is largely a mind-set issue, if and how widely we can give (people in BCC) access to our systems where they could search for certain information".* Thus, the buyer acknowledged that a substantial barrier to using Chinese engineering resources was due to internal "mental blocks" that prevented the buyer's personnel from seeing BCC as an equally sound option to the service provider's domestic resources. In addition, the buyer project members were accustomed to working with the supplier resources side-by-side, and breaking this habit was not straightforward. Challenges were also seen related to cultural differences, and the way how tasks were divided into very small entities in the Chinese engineering teams. The buyer felt that that this was not optimal considering the whole project.

In the investigated project, the companies agreed on a certain level of engineering workload that would be conducted by the service provider's BCC resources. Yet, an interesting observation here was the fact that the buyer did not have a clear purchasing strategy for engineering services. In general, the buyer was inclined to make purchasing decisions and

service provider selection on ad-hoc basis. To this regard, the buyer acknowledged that developing strategy for engineering services was highly in need: *"Asking for quotes for service packages is too ad-hoc at the moment, it should be more strategic. It is not clear who takes part, and who decides (on purchasing), we need to make these clearer (internally) (Director, Buyer).* The buyer realized that guidelines related to using BCC for engineering services were also missing. *"I think we need to define how we will purchase (engineering services) (and what share of this) is (conducted in) BCC. We don't have that kind of strategy.* (*Director, Buyer)* Additionally, the service provider recognized that the buyer's IPR strategy was not clear throughout the buyer organization.

Offering capable resources were underlined by the service provider as bringing value to the customer. The service provider ability to provide resources with right kind of capabilities for the specific knowledge domains was emphasized by the buyer, and the service provider paid close attention to fulfilling the buyer's needs in this respect. As the companies had been working together for years, the buyer had gathered in-depth knowledge on service provider personnel and individual skills and capabilities. Thus, the buyer was used to requiring a certain person from the service provider, whom the buyer knew that possessed a certain capability profile to execute a specific task. For the service provider, the idea in selling a service package however largely based on shifting emphasis from individual capabilities to capability on firm level with respect to delivering the agreed service package. *"From our perspective, it can get even too personified, whereby capabilities are related to a certain individual" (Dpt Mgr, Service provider).* With respect to the service package, the service provider was able to assume larger responsibility for resource planning and transferring resources between projects. Yet, as services were packaged to a larger entity, the buyer experienced that they lost visibility into the persons who were actually executing the tasks at hand.

Offering flexibility It was emphasized by the service provider that it was important that the customer could trust the service provider to be a flexible service provider. Perfoming as a flexible partner was seen to link with BCC resources: "*Flexibility comes from the fact that the customer has their own limited resources (for engineering) and considering that the needs differ, they need external service providers. We can provide these resources flexibly and bring cost efficiency by utilizing China"(VP, Service Provider).* Yet, the service provider experienced that being flexible was challenging due to changes at the end-customer: *"We need to be have the kind of collaboration whereby the customer trusts in us to be a global partner and flexible. But when timetables are delayed (at the end customer) this creates challenges (for us) (Director, Service provider).* Related to changes at end customer, the buyer similarly acknowledge that here, the service provider could have conducted more careful with resource planning "*The service provider could have been more understandable in a situation where the end customer was slow. I would have wished that the service provider would have been more careful with manning the tasks. Since when there are delays, the supplier will then tell us that we have idle resource standing here, they have nothing to do, and this will cause extra costs".* (*Engineering manager, Buyer).* Thus the buyer experienced that the service provider was not able to fully meet the expectations concerning flexibility in the investigated project.

Concentrating on core competencies constituted a key benefit that the service provider emphasized in the context of larger service packages. *"When we discuss value and benefits that we can bring to our customer, this is the corenerstone…the more (the customer) can shed their non-core (operations), the more they can reduce their fixed costs, because non-core can be done somewhere else"(VP, Service provider).* Yet, the data suggests that for the buyer, the issue of core-vs non-core and related outsourcing of engineering was not entirely straightforward. Some buyer informants saw risks relating to transfer of excessive knowledge and capabilities to the service provider that could potentially result in narrowing down the

buyer's own capability and knowledge base. To this end, the buyer was keen to preserve critical know-how within company own walls:*"We need to develop partnerships and BCC (share) in engineering. But this needs to be done with caution. So that we can keep our own technology knowledge in-house."(Director, Buyer).* At the same, the buyer wanted to ensure that their dependence on one supplier would not become too substantial. The service provider saw that by discussions with the buyer, they would be able to entice new ideas and thoughts around what could be potentially outsourced. Yet, the VP for engineering at the service provider did not relate outsourcing larger entities with a risk of losing proprietary knowledge in the same way as the buyer.

Introducing new ways of working between the companies related mostly to the habit whereby the supplier resources were situated in the buyer premises, working side-by-side with the buyer engineers during the projects. The continuous physical presence of service provider resources was regarded by the buyer as a comfortable and efficient way of working especially with regard to communicating. The buyer also appreciated the flexibility that this brought with respect to organizing tasks for idle supplier resources. The service provider acknowledged that the buyer appreciated this way of working, yet from their perspective, the set-up was also somewhat challenging. The service provider experienced that the buyer was tempted to think that only certain people at the service provider had the required capabilities. Delivering services in a larger package allowed the service provider to reduce their physical presence at the customer premises and conduct work from their own offices. The new way of working pushed the buyer personnel to renew their habits related to working with the supplier personnel. For the buyer, this was not an entirely positive change, as the buyer experienced this made communicating more difficult: *"Communication (with the service provider) could have been better. It is difficult to have two locations. It goes hand by hand in any case. (We use) e-mail and Skype but it is easier to sit together and explain things"* (*Chief Engineer, Buyer).* The buyer also felt that the new set-up where supplier resources were no longer physically present at the buyer premises increased the need for monitoring. The fact that service provider resources were no longer physically present in the buyer organization as previously also meant that the buyer was no longer able to use idle supplier resources for other internal engineering tasks.

Delivering a service package instead of individual engineering hours created the main difference in the project from the service provider perspective, and this was, according to their new sales strategy the way how they wanted to grow and the direction to where they wanted to develop their service offering in the future. Yet, delivering a service package meant that more emphasis needed to be paid to scoping the project and contracting than traditionally: "*As an appendix to the contract we crafted a table with two columns where it had been defined on detailed level what the buyer delivers to the service provider. And in the other column, what the service provider delivers to the buyer. This was a tool for our planning, and since we had a tight offer, and a tight contract, we also kept very closely to (what was defined) in the columns." (Chief Engineer, Service provider).* Yet, the buyer acknowledged that they would have needed to pay more attention to the contents of the contract and ensure that important terminology was understood in similar way on both sides of the dyad. The companies had agreed on principles related to charging additional work yet personnel in the project team on the buyer side were not informed about the principles. This accentuated the importance of communicating the agreed principles to people involved in the project**.**

Discussion

The findings highlight the various challenges that were experienced by the buyer and the service provider as the companies engaged in selling and purchasing engineering services as a value-added service package. The results suggest that improving customer cost-efficiency,

offering capable resources and flexibility, allowing the customer to concentrate on their core competencies and adopting new ways of working comprised ways of introducing value-adding elements to the relationship, which the service provider attempted to provide by delivering a service package instead of individual hours and resources. To this end, the study points to factors that appeared to hinder adoption of the value-based approach. The service package implied more utilization of the supplier's best-cost-country engineering resources in order to gain full benefit related to cost efficiency, yet this was met with resistance from some of the buyer personnel. The service package also implied less consideration for individual capabilities and skills of individual service provider persons, which had been the norm in the relationship up until the investigated project. So in this sense, the buyer felt that they lost visibility into who was actually conducting the tasks as well as the opportunity to use idle supplier resources for other tasks, which had been used to. The service provider saw one of benefits of a service package relating to the buyer's increased ability to concentrate on their core competencies. Yet, the data suggests that for the buyer, the issue of core-vs non-core and outsourcing of engineering was perhaps not as straightforward, and the buyer saw more potential risk in losing proprietary knowledge than the service provider. Finally, the service package implied that the supplier personnel was no longer working side-by-side with the buyer, yet the buyer's project team appeared to prefer the traditional way of working here the service provider's resources were physically present at the buyer's premises. In fact, working in separate locations was seen to cause difficulties in communicating with the supplier, and increased the need for monitoring that had not been needed previously. These findings contribute to advancing knowledge on implementation of value-based approach in service exchange with respect to factors that may slow down the adoption on both sides of the dyad (e.g. Meehan et al., 2017).

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Reshoring: Does home country matter?

Li Wan
Polytechnic Department of Engineering and Architecture, University of Udine, Via delle Scienze 206, 33100 Udine (Italy), E-mail: wan.li@spes.uniud.it, Tel:+39 0432558043

Guido Orzes
Faculty of Science and Technology, Free University of Bozen-Bolzano, Universitätsplatz 5, 39100 Bolzano (Italy), E-mail: guido.orzes@unibz.it, Tel: +39 0471017697

Marco Sartor
Polytechnic Department of Engineering and Architecture, University of Udine (Italy), Via delle Scienze 206, 33100 Udine, E-mail: marco.sartor@uniud.it, Tel: +39 0432558331

Guido Nassimbeni
Polytechnic Department of Engineering and Architecture, University of Udine, Via delle Scienze 206, 33100 Udine (Italy), E-mail: nassimbeni@uniud.it, Tel: +39 0432558333

Abstract
The purpose of this study is to analyze the effect of the home country on reshoring processes. Using a sample of 529 cross-industry reshoring initiatives from five countries (i.e., US, Germany, UK, France, Italy), we find that these initiatives significantly differ in terms of industry, entry mode choice, firm size and motivations among the countries analyzed. This study contributes to both reshoring and international business literature by highlighting the influence that the home country platform exerts in manufacturing repatriations. The study provides also significant implications for policy makers at a time when several governments are considering the economic and employment potential of reshoring.

Keywords: Reshoring, Home country effect, Multinational corporations (MNCs)

Paper type: competitive paper

Introduction

For several decades, offshoring – namely, the (re)location of activities from one country to another (Doh et al., 2009) – has been regarded as one of the most important strategies by Multinational corporations (MNCs), particularly in developed nations (Albertoni et al., 2016; Contractor et al., 2010). Although it is still ongoing, a converse trend has occurred referred to as "reshoring", i.e., "a voluntary corporate strategy regarding the home-country's partial or total re-location of (in-sourced or out-sourced) production" (Fratocchi et al., 2014)[1]. The reshoring phenomenon has been labeled with several terms (e.g., "reshoring", "back-reshoring", "backshoring"). In this paper, we adopt the term "reshoring".

According to some scholars (i.e., Tate, 2014), reshoring has been largely driven by industrial polices aimed at "bringing jobs back home". US represents probably the most evident case:

[1] The definition adopted in this study highlights these elements: a) it is a voluntary decision that it is not determined by nationalization and expropriation by host country governments, hence it is part of the firm's strategy; b) it may involve some specific production activities or the entire production of a foreign plant; c) it may concern both out-sourced and in-sourced activities, irrespective of the ownership mode. For a semantic discussion on the term and its different disciplinary origins, see Fratocchi et al. (2014, 2015).

the Obama administration has established the Advanced Manufacturing National Program (AMPSC, 2012) and implemented actions to strengthen the manufacturing sector (The White House, 2014). Assuming that reshoring will contribute to additional 2.5 to 5 million jobs in the US by 2020 (Boston Consulting Group, 2013), the US administration has offered financial and fiscal support to reshoring companies. In UK, the government agency UK Trade & Investment has joined forces with the Manufacturing Advisory Service (MAS) to launch a project titled "Reshore UK", which aims to help companies to bring production back home (GOV.UK, 2014). In Germany, the government has launched the "Industry 4.0" program and has offered financial incentives in order to facilitate reshoring (Stentoft et al., 2016). These evidences alone could suggest that home country matters in reshoring processes. But what does "home" mean? By the term "home country" we mean – according to a specific stream of studies – the firm's headquarters country. It could be argued that the "home" concept loses meaning in a global economy where companies are ready to move their roots to countries other than the country where the company is founded to capture location advantages (e.g., tax benefits). Some authors speak about 'nationless' organizations (Ferner 1997; Ohmae 1990). However, empirical evidence suggests that the aforementioned situation is relatively rare. More than 90% of firms are headquartered in the countries where firms are founded and have original and core operations (Ghemawat, 2007). For most MNCs, the home country is regularly the headquarters country (Mcgahan and Victer, 2010). Empirical evidence also suggests that even the most global MNCs are still deeply rooted in their home country (Hu, 1992; Noorderhaven and Harzing 2003; Ruigrok and Van Tulder 1995).

Scholars in international management fields have shown that culture, resources, national policies, and institutions of both home and host countries (i.e., countries that host their operations) influence the internationalization path of companies (e.g., Cuervo-Cazurra and Genc, 2008; Elango and Pattnaik, 2007; Holburn and Zelner, 2010; Mcgahan and Victer, 2010). Nevertheless, these studies are mainly focused on outgoing internationalization, that is, on the foreign expansion of an enterprise.

Considering the literature specifically focused on reshoring, prior studies have put much emphasis on the motivations (e.g., Gray et al., 2017; Wiesmann et al., 2017) and the "geography" of the reshoring process (e.g., Bailey and De Propris, 2014; Kinkel, 2009; Tate et al., 2014; Uluskan et al., 2016). However, they offer mostly *descriptive* pictures.

To the best of our knowledge, no study has analyzed so far the relationship between home country and reshoring. This relationship has potentially significant implications for re-internationalization strategies of companies and industrial policies of governments. Thus, the research question that inspires this study is the following:

How does the home country affect MNCs' reshoring processes?

Using a sample of 529 manufacturing reshoring initiatives, this study investigates the home country effect on the reshoring processes by comparing initiatives of five countries (i.e., US, Germany, UK, France, Italy).

The remainder of this paper is structured as follows. We first present the literature background. We then describe the methodology (data collection, sample description, data analysis). The main results of the statistical analysis are illustrated and discussed. Finally, we highlight the contribution of the paper and its limitations.

Literature background

The study of how home country affects firm's internationalization has been a mainstream topic in international business for decades (see Cuervo-Cazurra, 2011; Ramamurti, 2012 for reviews). Although prior research mainly focuses on the offshoring activities rather than reshoring, it provides valuable insights into the concept of home country and it shed light on the way in which home country effect manifests (i.e., the main factors that influence MNCs'

internationalization). We therefore frame and summarize this debate in the section *home country effect*, highlighting both its theoretical roots and the main factors/effects.
Besides this literature of international business, another research stream exists rooted in operations management and specifically dedicated to reshoring. Although this literature does not contain any in-depth cross-country study that analytically investigates the link between country and reshoring, it offers some useful insights for our study. The section *reshoring country-specific studies* summarizes this second stream of research.

Home country effect
The literature on the home country effects on firm's internationalization processes mainly draws from three theoretical perspectives: institutional theory, cultural/cognitive perspective, and resource-based view (RBV). The influence of home institutions and culture on firms' operations abroad and on overall performance has in fact been a predominant issue for scholars (Hoskisson et al., 2000; Peng et al., 2008). We summarize these perspectives in Table 1, also highlighting the main country-specific factors related to them.
The ***institutional*** approach argues that firms' strategic decisions, behaviors and performances are all shaped by the institutional context (DiMaggio and Powell, 1983). Institutions typically refer to a wide range of structures and include a vast array of regulative, normative, and cultural/cognitive elements. The ***cultural*** approach emphasizes the influence of home-country cultural values and norms on the management decisions and practices of MNCs (Hofstede, 1980). According to this perspective, individuals' (e.g., managers, executives, employees) behaviors are affected by experiences, values, beliefs, and attitudes that are in turn significantly shaped by their home-country environment. The ***resource-based view (RBV)*** theory considers firm as a bundle of resources, ranging from human and financial assets to managerial and technological skills (Grant, 1991). Under this perspective, the home country can be seen as a significant basin of resources: natural resources, image/made-in effect, and technology. As the reader may note, there is some overlapping among these theories, e.g., cultural aspects are included also in the institutional theory.
Each theoretical perspective, and in particular the institutional, the cultural/cognitive theories and the RBV, therefore identifies a set of factors associated with different forms, paths, modalities and outcomes in the internationalization processes of companies. We can classify these factors into five main groups: geographical (e.g., physical environment), political (e.g., politic risk, corruption), socio-cultural (e.g., values, norms, believes), economical (e.g., market size, economic development), and technological factors (e.g., technology development).

Table 1. Theoretical frameworks explaining home country effect

Theory/Concepts	Key assumptions	Country-specific factors
Institutional theory	Organizations must conform to the rules and beliefs prevailing in the environment. Coercive, mimetic and normative pressures generate institutional isomorphism.	- National business system - Political risk - Government policies - Institutional actors (e.g., state council, bank, ministry of commerce) - Regulations
Cultural/Cognitive perspective	Culture affects individual perception and behaviour, as well as firm-level processes, such as management styles, decision making and conflict resolution.	- Norms - Believes - Values - Imprinting - Risk taking attitude
Resource-based view (RBV)	Firms are bundles of tangible and intangible resources/capabilities (assets, processes, knowledge, and capabilities). To	- Country image - Technological level - Natural resources

	provide sustainable competitive advantage, these resources/capabilities should be valuable, rare, imperfectly imitable, and non-substitutable.	

As far as ***geographical*** factors are concerned, the literature highlights how climate, morphology, position and natural resources of the home country influence the way in which companies build their competitive advantages in foreign markets and address the internationalization processes.

As far as ***socio-cultural*** factors are considered, a large body of literature confirmed that 'cultural distance' has impact on firms' entry mode choice and Foreign Direct Investments (FDI). In this regards, the cultural approach relies heavily on Hofstede's (1980) dimensions. For example, Rothaermel et al. (2006) find that high uncertainty avoidance in a target country lowers the probability of market entry by US internet firms. Barkema and Vermeulen (1997) find that higher differences in uncertainty avoidance between the home and the host country increase the likelihood of a wholly-owned subsidiary over shared equity.

With regard to ***political*** factors, institution theory predicts that the political environment affects firms' internationalization. Scholars have examined an array of factors such as government form, politick risk and corruption. For instance, Brouthers et al. (2008) take a macro look at the effect of corruption on different types of FDI. Feinberg and Gupta (2009) find evidence of the increase of within-firm sales as an operational strategy when a firm faces greater political uncertainty.

Considering ***economical*** factors, authors argued that internationalization processes are significantly affected by the industrial development of the home country as well as by the home market size (e.g., He, 2011). Similarly, the ***technological*** development of the home country has been argued to affect these processes.

The aforementioned home country factors have been argued to affect a wide set of decisions in the internationalization processes, including (1) whether a company internationalize or not (He and Cui, 2012; Yaprak et al., 2017); (2) where does the company internationalize (i.e., host country) (Child and Rodrigues, 2005; Khanna and Palepu, 2010); (3) how does the company internationalize (i.e., entry or governance mode) (Chen et al., 2016; Contractor et al., 2014).

In sum, theories/concepts and factors analyzed above show that home country matters in internationalization processes. However, all these studies and theories are focused on offshoring processes.

Reshoring country-specific studies

Research on reshoring has mainly focused on motivations. In existing literature, scholars have identified a vast array of reshoring motivations such as made-in effect, government incentives, labor costs' gap reduction, energy costs (see Fratocchi, 2014; Di Mauro et al., 2017; Stentoft et al., 2016 for reviews). Although previous studies have pointed out that changes in the characteristics of either the home or host country influence the reshoring decisions (e.g., Ellram et al., 2013), and scholars called for further research on the role of home country in reshoring phenomenon (Tate, 2014), no empirical study investigated the impact of the home country on reshoring initiatives. The only exception is represented by Baraldi et al. (2017) who analyze the impact of the home-country and the host-country networks on reshoring processes. However, the network represents just one specific factor related to the home country and the paper is based on a single case study method.

The comparison of the country-specific reshoring studies could provide us some preliminary insights on the impact of the home country in reshoring processes. We therefore summarize

these studies – which focus on Denmark, Germany, Italy, New Zealand, Spain, US, and UK– in Table 2, highlighting their main findings. The table shows that reshoring companies of different countries have different features in terms of industry, firm size, entry modes, and main reshoring motivations.

In sum, while there is a wide literature on the home country effect on internationalization processes, such effect has not been analyzed so far in the reshoring context.

Table 2. Country-specific studies

Country	Industry involved	Firm size	Entry modes	Main reshoring motivations	Authors
Denmark	/	/	/	Quality, Lead-times, Increased use of automation in Denmark , Recognition of having production close to the Danish R&D department	Arlbjørn and Mikkelsen (2014)
Denmark	A variety of industries involved (e.g., House building)	Medium and large	/	Lower labor costs, Poor labor flexibility	Stentoft, et al. (2016)
Germany	A variety of industries involved (e.g., Machinery, Fabricated metal)	Small, medium and large	/	Flexibility and delivery ability, Quality problems	Kinkel and Maloca (2009)
Germany	A variety of industries involved (e.g., Basic metals and fabricated metal products, Machinery and equipment)	Up to 99 employees (62.9%), 100 to 499 employees (29.4%) 500 and more employees (7.6%)	/	Labor costs, Proximity to key customers, Access to new markets, Access to new knowledge/ technologies/clusters, Quality	Kinkel (2012)
Germany	/	/	In-sourcing/ Out-sourcing	Quality, Flexibility, Transport/logistics costs, Availability of qualified personnel, Labor costs, Know-how loss, Proximity to home-base R&D	Kinkel (2014)
Italy	Clothing and apparel	Medium and large	In-sourcing/ Out-sourcing	Protect the company's knowledge and competencies, "made in Italy" effect, Product quality, Strategic repositioning of the brand	Di Mauro et al. (2017)
New Zealand	Consumer and industrial goods	Small and medium	/	Flexibility/ability to deliver quickly, Problems with offshore quality, Country of origin brand, A sense of patriotism towards the home country	Canham and Hamilton (2016)
Spain	Footwear industry	/	In-sourcing/ Out-sourcing	Increase in domestic production, To reduce delivery times, Failures in market entry strategy	Martínez-Mora and Merino (2016)
UK	Automotive	/	/	Transport costs, Quality, Supply Chain resilience, Exchange rate shifts, Rising wages overseas	Bailey and De Propris (2014)
UK and	A variety of	/	In-sourcing/	UK: Productivity	Vanchan et

US	industries involved (e.g., Electronics, Apparel, Transportation)		Out-sourcing	improvements, Supply capacity US: Government and other institutional incentives, Energy price, Labor concessions	al. (2017)
US	Textile and apparel	Small, medium and large	/	Made-in effect, Speed-to-market	Uluskan et al. (2016)
US	A variety of industries involved (e.g., Electronics, Automotive)	Small, medium and large	/	Labor cost gap, Energy cost, Skilled-labor, Labor output/productivity per labor dollar, Innovation	Tate et al. (2014)
US	A variety of industries involved (e.g., Electronic, Fabricated metal products)	/	/	Quality, Lead time, Shipping cost, Wage, Market demand	Zhai et al. (2016)

Methodology

Data

In order to analyze of the reshoring phenomenon, we used two databases: the "Uni-CLUB MoRe Back-reshoring" and the "European Monitor on Reshoring." The latter was funded by the European Union Agency Eurofound and is managed by a research team that includes the authors. Secondary data have been used both in international business and in operations management research (Roth et al., 2008; Yang et al., 2006).

Data were collected from 2011 to the end of 2016 through a keyword search in the major international and national business-related newspapers, reports, and magazines, as well as white papers published by relevant consulting firms and public institutions. The keyword search included terms such as: "Back-reshoring", "Backshoring" "Back-shoring", "Inshoring", "In-shoring", "Nearshoring", "Near-reshoring, "Onshoring", "on-shoring", "Production relocation", "Production repatriation", "Relocalisation", "Reshoring".

The unit of analysis was the individual reshoring decision[2]. For each individual case, information was collected on firm size, industry, headquarter location, reshoring motivations, duration of stay abroad, off- and re- shoring countries, entry modes (i.e., out-sourcing vs. in-sourcing), and years. Industries were classified into seven groups based on the Standard Industrial Classification (SIC) codes: clothing, electronics, mechanical, automotive, home appliance, furniture, food and other sectors. Regarding firm size, we classified companies into two categories (i.e., small and medium, and large) based on the number of employees and revenues, following a recommendation of the European Union Commission (2003/361/EC). The information on reshoring entry mode was classified into two groups: in-shoring vs. out-sourcing (see Pan and Tse, 2000). Finally, motivations were coded based on an extensive review of the reshoring literature (see Fratocchi et al., 2016).

Further methodological information concerning the database and the data collection is available on the observatory's website (https://reshoring.eurofound.europa.eu/) and in previous studies (e.g., Ancarani et al. 2015; Fratocchi et al., 2016).

Starting from the 747 reshoring cases recorded in the databases, 70 cases were removed due to missing or unreliable data. A further 148 cases were removed because the number of cases

[2] The single project (single reshoring decision) has been widely used as unit of analysis (UOA) in reshoring studies. MNCs do not necessarily reshore the whole of offshored activities or close a whole plant in host countries. In some instances, they just repatriate part of offshored activities. In addition, many MNCs offshored production activities in various host countries, and it is not always the case that MNCs reshore the entire production activities from all the host countries. Repatriating production activities from two different host countries by the same MNC is considered as two reshoring decisions. Thus, the single project (individual reshoring decision) is used as UOA in our study.

belonging to a specific country was lower than 20, the threshold we used for a minimal country-based characterization. Our final sample includes therefore 529 reshoring cases covering five countries (US, Italy, UK, Germany, and France).

Descriptive statistics of the sample

Table 3 provides the main descriptive data on industry, firm size, reshoring entry mode and motivations for the full sample (N=529) and the five national subsamples (US, Italy, UK, Germany, France).

The data shows that the home countries of reshoring initiatives are almost equally distributed between European Union (45%) and US (55%). If we consider the country (rather than the region), US is at the first position (290 cases) followed by Italy (92 cases), UK (60 cases), Germany (49 cases), and France (30 cases). Most of the cases in the full sample belong to four industries: clothing, electronic, mechanical, and automotive. Significant differences can however be observed among the analyzed countries considering the most frequent sectors: clothing for Italian companies, mechanical for German companies, "other" (mainly chemical products, toys, bio-medical, and sports equipment) for US and French companies. As far as firm size is considered, SMEs and large firms are almost equally distributed for the full sample (233 vs. 296, 44% vs. 56%). However, the share of large firms is significantly higher in the German subsample (89.8%). Regarding the entry mode choice, the data shows that in-sourcing has been adopted by most of reshoring case regardless of the home country. The share of German companies that adopted in-sourcing entry modes is however higher than the one of other companies (i.e., 98% vs. 79.2% on average), thus suggesting that the entry mode choice of reshoring companies may be affected by home country. With regards to the reshoring motivations, we present the most frequent motivations identified (8 out of 26): logistic costs, made-in effect, quality issues, labor costs' gap reduction, delay in delivery, total cost, customer proximity, and government incentives. Again, it is possible to notice some significant differences between countries, among which: (1) the "made in effect" seems to be very important for Italian companies; (2) the labor costs' gap reduction is not much relevant for Italy, Germany and France companies; (3) logistics costs are very important for US companies; and (4) government incentives are mentioned only by US, UK, and France companies.

Table 3. Sample characteristics (N=529)

	Home country												
	All (N=529)		**US (N=290)** (55.0%)		**Italy (N=92)** (17.3%)		**UK (N=60)** (11.3%)		**Germany (N=49)** (9.2%)		**France (N=38)** (7.1%)		**Chi square test[a]**
Industry													
Clothing	87	16%	34	12%	32	35%	11	19%	2	4%	8	21%	
Electronic	82	16%	45	16%	17	18%	9	15%	6	12%	5	13%	
Mechanical	88	17%	51	18%	12	13%	7	12%	17	35%	1	3%	
Automotive	60	11%	31	11%	7	8%	6	10%	9	18%	7	18%	
Home appliance	29	5%	20	7%	4	4%	3	5%	1	2%	1	3%	χ^2= 57.476
Furniture	27	5%	15	5%	7	8%	2	3%	0	0%	3	8%	*P*<0.01
Chemical	21	4%	7	2%	5	5%	3	5%	5	10%	1	3%	
Food	16	3%	10	3%	1	1%	2	3%	1	2%	2	5%	
Other	119	22%	77	27%	7	8%	17	28%	8	16%	10	26%	
Firm size													
SME	233	44.0%	152	52.4%	31	33.7%	35	58.3%	5	10.2%	10	26.3%	χ^2= 44.825
Large	296	56.0%	138	47.6%	61	66.3%	25	41.7%	44	89.8%	28	73.7%	*P* <0.01
Reshoring entry mode													
In-sourcing	419	79.2%	233	76.9%	73	79.3%	43	71.1%	48	98.0%	32	84.2%	χ^2= 14.052
Out-sourcing	110	20.8%	67	23.1%	19	20.7%	17	28.3%	1	2.0%	6	15.8%	*P* <0.01
Reshoring motivations													
Logistic cost	112	21.2%	84	29.0%	9	9.8%	8	13.3%	5	10.2%	6	15.8%	χ^2= 24.105 *P* <0.01
Made in effect	97	18.3%	60	20.7%	29	31.5%	4	6.7%	1	2.0%	3	7.9%	χ^2= 28.667 *P* <0.01
Quality issues	95	18.0%	65	22.4%	7	7.6%	9	15.0%	13	26.5%	1	2.6%	χ^2= 19.455 *P* <0.01
Labor costs' gap	82	15.5%	60	20.7%	4	4.3%	12	20.0%	3	6.1%	3	7.9%	χ^2= 20.594 *P* <0.01
Delay in deliveries	78	14.7%	54	18.6%	1	1.1%	16	26.7%	5	10.2%	2	5.3%	χ^2= 27.423 *P* <0.01
Total cost	69	13.0%	46	15.9%	5	5.4%	14	23.3%	1	2.0%	3	7.9%	χ^2= 19.112 *P* <0.01
Customer proximity	86	16.3%	52	17.9%	17	18.5%	13	21.7%	0	0.0%	4	10.5%	χ^2= 20.594 *P* <0.05
Government incentives	53	10.0%	41	14.1%	0	0.0%	8	13.3%	0	0.0%	4	10.5%	χ^2= 28.733 *P* <0.01

[(a)] Fisher's exact test (rather than Chi square) was performed for two variables (i.e., total cost and government incentive) as the data was non-normally distributed.

Data analysis

We performed two set of statistical analyses.

First, we compared the reshoring initiatives of the five countries in terms of industry, firm size, reshoring entry mode, and reshoring motivations and tested the significance of these overall differences through Chi square test or Fisher's exact test (when data were non-normally distributed).

Second, to shed light on the peculiarities of each country compared to the others, we performed five binary logistic regression models. Such models have estimated the probability that a reshoring case belong to a particular country rather than to the others based on the industry, the firm size, the reshoring entry modes, and the motivations. The dependent variable (i.e., the home country) was therefore a dummy variable equal to 1 if the case belongs to the considered country and to 0 if it belongs to the other countries. The independent variables were operationalized through dummy variables too: *clothing*, *electronic*, *mechanical*, and *automotive* for industry; *large firms* for firm size, *in-sourcing* for

reshoring entry mode; and *logistic costs, made-in effect, quality issues, labor costs' gap reduction, delay in delivery, total cost, customer proximity, and government incentives* for reshoring motivations. The final resulting logit equations are shown below:

$Y_i = \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 X_{i4} + \varepsilon_i$

(Y_i=home country$_i$, X_1=industry, X_2=firm size, X_3=reshoring entry mode, X_4=reshoring motivations)

Results

The results of the first set of analyses (i.e., Chi square / Fisher's exact tests) are reported in the last column of Table 3. They show that the reshoring initiatives of the five analyzed countries significantly differ in terms of industry, firm size, reshoring entry mode, and reshoring motivations.

To further shed light on the peculiarities of each country, we then performed a set of binary regressions reported in Table 4. The correlation matrix and the analysis of the Variance Inflation Factors (VIF) (all lower than 2) reveal that multi-collinearity was not an issue (Allison, 1977, 2012).

Our analyses show that the ***industry*** distributions of reshoring companies are different between countries, especially for Germany and Italy. While mechanical and automotive reshoring companies are more likely to be German (β=1.231, P<0.01; β=0.960, P<0.05, respectively); clothing and electronic ones are more likely to be Italian (β=1.497, P<0.01; β=0.953, P<0.05, respectively). Similarly, clothing reshoring companies are less likely to be American (β=-1.018, P<0.01), and mechanical reshoring companies are less likely to be French (β=-1.893, P<0.1). For UK companies, the industry variables are not statistically significant.

Considering ***firm size***, we found that large reshoring firms (β=2.131, P<0.01) exhibit a higher propensity to be German, by contrast, reshoring SMEs are more likely to be American or English (β=-.410, P<0.05; β=-622, P<0.1, respectively). For Italian and French companies, the variable firm size is not significant.

As far as reshoring ***entry mode*** is considered, we find that reshoring companies adopting an equity solution (i.e., in-sourcing) are more likely to be German (β=2.535, P<0.01), while reshoring companies adopting non-equity solutions (i.e., out-sourcing) are more likely to be American (β=-.502, P<0.1). The entry mode variable is not significant for the other countries.

Considering ***reshoring motivations***, US companies are motivated strongly by the government incentives (β=1.285, P<0.01), logistic costs (β=.696, P<0.05), labor costs' gap reduction (β=.628, P<0.05), made-in effect in home country (β=.466, P<0.1), and higher production quality in home country (β=.478, P<0.1). By contrast, Italian companies are motivated strongly by made-in effect (β=.807, P<0.01), while they are less likely to be motivated by delay in delivery (β=-2.895, P<0.01), labor costs gap reduction (β=-1.394, P<0.05) and higher production quality in home country (β=-.813, P<0.1). UK companies are motivated strongly by delivery reliability in home country (β=1.162, P<0.01), while they are less likely to be motivated by logistic costs (β=-1.542, P<0.01), made-in effect (β=-1.515, P<0.01), and higher production quality in home country (β=-.718, P<0.1). German companies are motivated by the higher production quality in home country (β=1.238, P<0.01), while they are less likely to be motivated by made in effect (β=-2.327, P<0.05) and total cost (β=1.177, P<0.1). Finally, French companies are less likely to be motivated by higher production quality in home country (β=-1.819, P<0.1) and made in effect (β=-1.819, P<0.1).

Table 4. The results of the binary logistic regressions

Variables	US vs. others N=529 (US=1; Other = 0)		ITALY vs. others N=529 (Italy=1; Other = 0)		UK vs. others N=529 (UK=1; Other = 0)		GERMANY vs. others N=529 (Germany=1; Other = 0)		FRANCE vs. others N=529 (France=1; Other = 0)	
	Coefficient (b)	Std. error	Coefficient (b)	Std. error	Coefficient (b)	Std. error	Coefficient (b)	Std. error	Coefficient (b)	Std. error
Constant	.524	.315*	-2.181***	.452	-1.554***	.437	-6.492***	1.296	-2.672***	.656
Industry										
Clothing	-1.018***	.294	1.497***	.359	.017	.428	-.528	.811	.456	.516
Electronic	-.313	.282	0.953**	.374	-.210	.433	-.069	.533	-.201	.539
Mechanical	-.159	.278	.459	.402	-.656	.466	1.231***	.432	-1.893*	1.044
Automotive	-.255	.319	-.246	.469	-.303	.508	0.960**	.490	.236	.500
Firm size										
Large	-.410**	.204	.366	.275	-.622*	.317	2.131***	.538	.505	.417
Entry mode choice										
In-sourcing	-.502*	.257	.152	.348	-.142	.363	2.535**	1.070	.321	.527
Reshoring Motivations										
Logistic costs	.696**	.281	.112	.436	-1.542***	.488	-.036	.575	.272	.553
Made-in effect	.466*	.259	.807***	.301	-1.515***	.558	-2.327**	1.041	-1.177*	.641
Quality issues	.478*	.263	-.813*	.436	-.718*	.424	1.238***	.437	-1.819*	1.032
Labor costs'gap reduction	.628**	.302	-1.394**	.580	.549	.411	-1.019	.685	-.665	.689
Delay in delivery	.171	.301	-2.895***	1.039	1.162***	.379	.546	.611	-.740	.782
Total cost	.140	.303	-.731	.525	1.024	.393	-1.757*	1.051	-.118	.653
Customer proximity	.199	.271	.069	.346	.463	.381	-18.572		-.129	.584
Government incentives	1.285***	.359	-19.968		.626	.449	-18.911		.128	.588
-2 log likelihood	653.017		407.345		330.187		243.104		245.374	
Cox and Snell R^2	.133		.143		.080		.146		.051	
Nagelkerke R^2	.178		.237		.157		.317		.128	

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Note: Government incentives variable was excluded from the Italy and Germany models since there were no cases pointing out this motivation. Customer proximity variable was also excluded from the Germany model for the same reason.

Discussion

Overall, our empirical results provide strong evidence that reshoring differs significantly in terms of industry, motivations, entry mode, and firm size between the countries analyzed. To the body of studies that reveal that the home country matters in firms' offshoring, this study shows that it also influences the reshoring process. In the following subsections we will discuss the results assuming a country-based perspective, i.e., trying to understand which factors distinguish reshoring in each country.

US

Compared to other countries, the distinctive characteristics of US reshoring processes concern the industry (clothing significant and negative), the firm size (significant and negative), the entry mode (outsourcing prevails), and some motivations (logistic costs, made-in effects, quality issues, labor costs' gap reduction, government incentives). As far as industry is concerned, the US textile and clothing sectors have reduced considerably in recent decades:

the share of these sectors on gross domestic product fell to 0.16% in 2015 from 0.57% in 1998 (Lu, 2017). Unlike other countries such as Italy, US textile and clothing has migrated massively abroad, this way weakening the domestic manufacturing base and making it less able to take productions back.
US reshoring is also characterized by the smaller size of the reshoring enterprises and a greater propensity to outsourcing. These figures may come as a surprise, since US is generally regarded as the country of the large global multinationals. One possible explanation is that in the US, more than in other countries, manufacturing activities are in the hands of small businesses, while large companies privilege other value chain activities. In other words, we can assume that large US manufacturing firms tend to maintain a "smiling curve" pattern in geographical value distribution (see Mudambi, 2008).
Instead, it is not a surprise to see that government incentives and labor and logistic cost motivations distinguish American companies from others. The US Government has provided substantial fiscal incentives and other support to reduce the manufacturing costs in order to attract investments. It is then possible that the renewed energy efficiency, thanks to shale gas, has allowed the reduction of some cost categories.
This finding is consistent with the study conducted by Tate et al. (2014), which show how cost is a significant driver of the reshoring decision. In addition, US companies increasingly realize that quality problems can be serious in some markets, even if they are considered to be a factor that is not fully quantifiable (Gray et al., 2017). Poor production quality in offshoring countries (e.g., China) is another important driver. In line with the national survey conducted by the Consumer Reports National Research Center, 78 percent of Americans would like to buy the product made in the USA rather than abroad (Consumer Report, 2013).

Italy
Italy is in second place after the United States by number of reshoring initiatives. Its reshoring processes are significantly characterized in terms of industry (clothing and electronic) and some motivations (made-in effect). These results should be understood in the light of Italy's manufacturing specialization, where textile/clothing industry and some electronics subsectors represent relevant part of the manufacturing system. In the last few years, these industries have undergone intense relocation processes that in many cases have betrayed the quality, delivery, and even costs expectations. Especially in fashion-sensitive markets, a remote production increases delivery and quality problems. In order to differentiate against the offer coming from low cost countries, many Italian companies have decided a market reposition in segments with higher added value, where the made-in effect is more important. The fashion market has been considerably reactive to first-class products entirely “Made in Italy”, a country that stands for an array of unique and irreplaceable qualities (Vladi, 2016) and that can give a specific value to the made-in factor. It is worth noting that both the clothing and the consumer electronics industries are characterized by dynamic demand patterns, short product life cycles, and high mix and volumes flexibility requirements. These aspects have reasonably favored the re-composition of a manufacturing base closer to the outlet European markets.

Germany
The distinctive characteristics of German reshoring processes concern the industry (mechanical and automotive), the firm size (large), the entry mode (insourcing prevails), and some motivations (quality issues, made-in effects and total cost are both significant and negative). The excellence of the mechanical and automotive industry, and more generally of German engineering, is known worldwide. This country has built a significant competitive advantage in these sectors based on world-class R&D infrastructures, highly skilled

workforce and integrated value chains. Germany continues to heavily invest in innovation and is now one of the pioneering countries in Industry 4.0 technologies. It is also characterized by the originality of industrial relations, where workers and trade union representatives have significant power, particularly in large-sized companies. There are examples of German firms where precisely a shareholder agreement between ownership and workers ("mitbestimmung") has allowed to save or even to increase jobs. The consultation between government, unions and the Federation of German Industries on industrial projects based on innovation and quality has led to significant wage growth in the last years.
Our data are consistent with this country profile. German companies, particularly large ones operating in the leading manufacturing sectors, are focusing on quality and pursuing reshoring paths based on internal governance. Insourcing (equity solutions) can in fact better protect jobs and justify intangible (workers educations) and tangible investments, particularly in high-tech and capital-intensive industries. This evidence is in line with earlier observations by Lewin and Couto (2007) and Hutzschenreuter et al. (2011).

UK
Reshoring in the UK is distinguished by the smaller size of the companies and the dominance of time motivation, while logistics costs and made-in effects are significant motivations but have negative coefficients. Therefore, UK reshoring processes appear to be less characterized than those of US, Germany and Italy. This figure may be the result of two opposing factors. On the one hand, several surveys highlight the need in many British manufacturing sectors to create shorter and more responsive supply chains and easier communication with customers (Moradlou et al., 2016). Actually, UK's manufacturing has undergone relevant changes over the past few decades, ceasing to focus on price and now concentrating on customization and service. On the other hand, UK is one of the western countries that saw a greater reduction in manufacturing, although it currently ranks at ninth position among the largest manufacturing nation. In addition, a large part of the manufacturing industry (such as the automotive) is controlled by foreign investors, who may therefore not consider UK as "home".
It should also be noted that the UK has probably been the most active European country in terms of reshoring policies, but this effort does not seem to be recognized by businesses (the "government incentives" factor is not significant). Finally, it is possible that in the future the depreciation of the pound after "Brexit" may encourage domestic sourcing and greater investment into the UK.

France
Reshoring in France appears significantly different in terms of industry (mechanical, significant but negative) and motivations (made-in effect, quality issue). It is worth to remember that this significance must be understood in comparative terms: it is less likely to find mechanical companies, made-in effect and quality-issues motivations among French reshoring firms compared to companies in other countries. According to the data of this study, France therefore appears to be the least characterized country, an aspect that we are unable to coherently interpret at this stage of the study.

Conclusions and limitations
This study contributes to the literature on home country effect in three significant ways. *First,* this research extends literature on home country effect to reshoring initiatives, demonstrating the home country has strong effects on reshoring practices. *Second,* by comparing the effect of home country on reshoring practices between five countries, we empirically contribute to a

deeper understanding of reshoring phenomena from knowing which factors affect the likelihood of undertaking reshoring strategy in each country. *Third*, this study develops a broadened interpretation of the home country effect by analyzing practices jointly.

This study also offers several implications for both mangers and policy-makers. For mangers, it helps them to make deliberate decisions by carefully evaluating the home country environments and the specialization of business. For policy-makers, it highlights the importance of being aware of the demand of the companies in different industry and making policies which could provide competitive advantages.

We acknowledge some limitations in this study. *First*, our study used secondary data, further research could build on our work and improve the reliability of the data by conducting a survey. *Second,* we did not include contingency factors in our model. To further advance the understanding of home country effect, future research could for instance explore the moderating role of the country from where the company move back production.

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Why offshore manufacturing to high-cost countries?

- Evidence from Chinese firms

Weimu You, Yuan Virtanen

Aalto University School of Business

Runeberginkatu 22-24, FI-00076, Helsinki, Finland

weimu.you@aalto.fi; yuan.virtanen@aalto.fi

Abstract

Earlier research has studied offshore manufacturing from high-cost countries to low-cost countries, while recent years have seen the investigation of reshoring, i.e. the reversal of previous offshoring decisions from low-cost countries to high-cost countries. However, few studies have examined offshore manufacturing initialed by firms from low-cost countries to high-cost countries. In this paper, we fill in the gap by studying the motivational factors for Chinese firms to offshore manufacturing to high-cost countries, by analyzing secondary data extracted from newspapers and magazine sources. Additionally, we propose a theory-based classification framework for the analysis of offshore manufacturing from low-cost countries to high-cost countries.

Keywords: Offshore manufacturing, High-cost countries, China

Introduction

Since the emerging of the offshoring phenomenon decades ago, firms from high-cost countries (in this paper, we regard all developed countries as high-cost countries) have been motivated to offshore their manufacturing activities mainly to low-cost countries for sustained competitive advantage (Ferdows, 1997). This phenomenon of offshoring has received very much attention from not only the business world but also academia (cf. Fredriksson and Jonsson, 2009; Jia, Lamming, Sartor, Orzes, and Nassimbeni, 2014; Wang, Singh, Samson and Power. 2011). However, various costs have been drastically rising in some of the former low-cost countries (Kumar, 2009). At the same time, other factors such as trade policies (Ellram, Tate and Petersen, 2013) and government subsidies on repatriations (Livesey, 2012) also come into play. More and more firms from high-cost countries that once offshored their manufacturing to low-cost countries have started to gradually reshore manufacturing activities back to their home countries (Kinkel, 2014; Kinkel, 2012). In academia, this notion of reshoring by reversing earlier offshoring decisions from low-cost countries to high-cost countries also attracted a lot of interest, especially in recent years (cf. Förstl, Kirchoff and Bals, 2016; Zhai, Sun and Zhang, 2016; Gray, Esenduran, Rungtusanatham and Skowronski, 2017; Ketokivi, Turkulainen, Seppälä, Rouvinen and Ali-Yrkkö, 2017). Although numerous earlier studies have examined the motivations of firms from high-cost environments to offshore manufacturing to low-cost countries as well as the relocation of manufacturing from low-cost environments to high-cost countries, few studies have attempted to investigate the motivations of firms from low-cost environments to offshore manufacturing from their home countries to high-cost countries.

This paper aims to fill this gap by investigating the motivations for firms from low-cost environments to offshore manufacturing from their home countries to high-cost environments. Furthermore, it also attempts to understand the home- and host-country specificities of the manufacturing locations. There are two research questions for this study, first, *what are the motivational factors for firms from low-cost environments to offshore manufacturing to high-*

cost environments?, and secondly, *what are the home- and host-country specificities of the manufacturing locations?* By examining these two research questions through the theoretical lens of Dunning's "eclectic paradigm" (Dunning, 1980, 1988, 1998), a theory of international production by multinational enterprises (MNEs), this study contributes to the literature of manufacturing location decision and provides managerial implications for firms from low-cost countries on why they might need to relocate their manufacturing from their home countries to high-cost environments.

In the following sections of this article, a review of literature will be provided first. Then, the research methodology of this paper will be presented. Followed by the demonstration and analysis of data, the research questions of this study will be answered. In the end of this article, the theoretical contributions as well as managerial implications of this research will be discussed. This paper will conclude with the limitations of this research and suggestions for future research avenues.

Literature review

Three streams of literature will be reviewed for this study: 1) Offshoring and its motivations; 2) Reshoring and its motivations; and 3) Eclectic paradigm, which together will form the basis for understanding the motivations of offshore manufacturing for firms from low-cost countries to high-cost countries.

Motivational factors of manufacturing offshoring

Offshoring is defined as being located or operating outside a country's boundaries (Jahns et al., 2006). Since academia started to focus on the concept of offshoring in the early 2000s, a large number of empirical studies have investigated the motivational factors of companies for offshoring manufacturing. Notably, *Cost reasons, opening up new markets, access to foreign distribution channels, access to materials and goods, producing in the proximity of the customer, securing knowledge* as well as *following the investor* are among the most important factors of manufacturing offshoring identified in extant research. (cf. Dunning, 1980, 1988; Hollenstein, 2005; Kinkel, Lay and Maloca, 2007; Kinkel and Maloca, 2009; MacCarthy and Atthirawong, 2003).

Reshoring and its motivations

Reshoring is defined as the relocation of value creation tasks from offshore locations to geographically closer locations such as domestic or nearshore countries (Förstl et al, 2016). Since the notion of reshoring emerges as a hot top in recent years, many studies have examined the motivations of reshoring (cf. Ellram, 2013; Fratocchi, Di Mauro, Barbieri, Nassimbeni and Zanoni, 2014; Gray, Skowronski, Esenduran and Rungtusanatham, 2013). In a research on the motivations for reshoring manufacturing, Fratocchi, Ancarani, Barbieri, Di Mauro, Nassimbeni, Sartor, Vignoli and Zanoni (2016) identified 31 prominent motivations of reshoring by reviewing both scholarly and practitioner studies, which include: *labor costs' gap reduction*; *lack of skilled workers in the host country*; *logistics costs*; *supply chain coordination costs*; *made-in effect*; *energy costs*; *total cost of sourcing*; *exchange rate risk*; *freight costs* and *national subsides for relocation* among others.

Although as many as 31 motivations were identified from different sources in their study, Fratocchi *et al.* (2016) also pointed out that only fewer than three motivations were suggested in 15 of the 33 papers while 11 motivations were found in only one paper. Two motivations, namely *reduction of labor costs between host and home countries* and *poor quality of production abroad* were found to be the most frequently cited motivations of reshoring. Based

on the former studies of reshoring motivations, Fratocchi *et al*. (2016) moved on to examine secondary data extracted from newspapers and magazines and built a database of cross-country and cross-industry reshoring decisions/projects. This laid the foundation for a theory-based interpretative framework for motivations of manufacturing reshoring, which highlights four main typologies of reshoring motivations, namely *customer perceived value*, *cost efficiency*, *internal environment* and *external environment*.

Eclectic paradigm

Many theoretical perspectives including transaction cost economics (TCE) and resource-based view (RBV) have been adopted to explain firms' manufacturing location decisions (Ellram, Tate and Billington, 2008; Williamson, 2008; Canham and Hamilton, 2013). In addition, Dunning (1980; 1988; 1998) suggested three determining variables of foreign direct investment (FDI) by MNEs in his "eclectic paradigm": *ownership advantages*, *location advantages*, and *internalization advantages*. In spite of the original aim to help understand firms' international expansion, this theory has also been employed to explain manufacturing location decision, including offshoring and reshoring (Ellram et al., 2013). In this study, we select Dunning's eclectic paradigm, specifically the *location advantages*, as the theoretical lens to help us categorize and interpret motivational factors derived from our data. As our study focuses on manufacturing location decisions on country-level and we do not consider the make-or-buy aspect, eclectic paradigm's *location advantages* make a suitable tool for our analysis.

In 1998, Dunning modified his eclectic paradigm developed in the 1970s and 1980s, as "firm-specific assets have become mobile across natural boundaries" (Dunning, 1998, p.5). Four updated locational factors were proposed: 1) *Resource seeking*: availability of natural resources, infrastructure, and local partners. 2) *Market seeking*: access to domestic and regional markets, availability and price of skilled labor, availability of related firms (e.g., leading suppliers) and users in knowledge intensive sectors, and host government policies. 3) *Efficiency seeking*: production cost related factors, governments' removal of trade obstacles, and availability of specialized special clusters. 4) *Strategic asset seeking*: price and availability of knowledge-related and "synergistic" assets, and access to different cultures, institutions, systems and consumer demands and preferences.

To sum up, from the above literature, it can be noted that companies from high-cost countries have traditionally left their home countries to relocate manufacturing activities to low-cost host countries, due to cost reasons, opening up new markets and access to foreign distribution channels, materials and goods. Recently, companies from high-cost countries that once moved their manufacturing to low-cost countries are either returning to their home country or relocating to a location that is considered high-cost, due to factors such as customer perceived value, cost efficiency, internal environment and external environment. In this research, the research problem of motivations for firms from low-cost home countries to high-cost host countries are in essence relating to the concept of offshore manufacturing as well as the reshoring notion of moving production from low-cost countries to high-cost environments. After reviewing the motivations for offshoring manufacturing and reshoring, and by means of location advantages from eclectic paradigm, this research attempts to reveal the motivations for firms to offshore manufacturing from low-cost countries to high-cost countries.

Methodology

In this study, we built a data set involving cross-country and cross-industry cases using secondary data extracted from newspaper and magazine sources, a method adopted from Fratocchi *et al*. (2016), to understand Chinese firms' motivations and home- and host-country specificities to offshore manufacturing to high-cost environments.

Secondary data has been adopted in social science, business ethic research and international business research (Judd, Smith and Kidder, 1991; Cowton, 1998; Yang, Wang and Su, 2006), and has become an emerging trend in the operations management field as well (Roth, Schroeder, Huang and Kristal, 2008; Yeung, Lo, Humphreys and Wiengarten, 2016; Fratocchi et al., 2016). The use of secondary data on the one hand allows researchers to "verify and/or extend previous empirical research built on primary data" (Yeung et al., 2016, p.309), on the other hand, it also offers data sources when primary data is difficult to obtain (Cowton, 1998). In our case, the phenomenon of Chinese offshoring manufacturing to high-cost environment is unfolding and ongoing, thus public secondary data is not widely available. In addition, newspaper articles, as a type of secondary data, can provide timely and pertinent research source (Bain, 1994) to assist us capture the essence of these contemporary events in a longitudinal context.

We have created a data set on offshoring manufacturing from China to high-cost countries from 2001 to early 2017. Our data set includes an excel file of cases with company names, industries, host countries and regions, offshoring year, and article sources, another excel file of motivational factors of each case, and a list of searched keywords. Before the data collection, we carried out a pre-testing with twenty sources, to ensure the two researchers have an aligned inclusion and exclusion criteria for cases. Chinese firms' overseas production activities involving joint ventures with local firms, mergers and acquisitions of local firms, and natural resource exploitations were excluded. The agreed criteria was then applied to the entire sample.

We collected the data according to the following steps. First, we searched for newspaper articles adopting offshoring-relating keywords (such as moving production to, start production in, and establishing a factory in, etc.) together with names of developed economies based on UN's most recent country classification (see Table 1) in the CNKI (China National Knowledge Infrastructure) database. UN has categorized developed countries based on their geographic locations, and this categorization will be adopted in this study to analyze the location of the host-countries. CNKI is China's largest and most comprehensive academic online library, which covers more than 600 core full-text Chinese newspapers (CNKI, 2017). Both authors are native Chinese speakers and the working language of the team is English. We have discussed carefully and reached consensus on the translation of each keyword and motivational factor extracted. A keyword table in both Chinese and English language is created to ensure transparency and traceability. We then used internet search engines, namely Google and Baidu, to search for magazine articles as well as company announcements, with the above-mentioned keywords to further check that no relevant information concerning moving manufacturing from China to high-cost environments was missing. Similar to Fratocchi et al. (2016)'s approach, our unit of analysis was the single decision/project move manufacturing from China to high-cost environments. We accounted two cases if a company has moved production from China to two different high-cost host countries.

Table 1. Developed economies (UN Country classification, 2017)

EU Member countries		**Other Europe**	**North America**	**Developed Asia and Pacific**
EU-15	EU-13	Iceland	Canada	Australia
Austria	Bulgaria	Norway	United States	Japan
Belgium	Croatia	Switzerland		New Zealand
Denmark	Cyprus			
Finland	Czech Republic			
France	Estonia			
Germany	Hungary			
Greece	Latvia			
Ireland	Lithuania			

Italy	Malta			
Luxembourg	Poland			
Netherlands	Romania			
Portugal	Slovakia			
Spain	Slovenia			
Sweden				
United Kingdom				

For data analysis, we applied a content-analysis method inspired by Krippendorff (2004). The purpose was to identify the various motivational factors influencing firms' offshoring manufacturing decisions. Motivational factors were inferred from interviews with companies reported in the article, or from reporters' description of the case. As the process of extracting motivational factors from large text pieces and categorizing them is interpretive, to avoid misinterpretation, both researchers reviewed each case and categorized observed motivations independently. Then the results were cross-validated. In case of different results, both researchers reviewed the source article together, discussed carefully, and reached an agreed decision.

Results

The data set consists of 101 cases belonging to 86 unique companies, as 14 companies (over 16 percent of the total) implemented more than one offshore manufacturing operation (from two to four). In summary, a few industries stand out by a higher number of cases, such as clean energy, milk powder, automotive and household appliances. Our data show that the vast majority of the firms that have engaged in offshore manufacturing are private firms, and only a minority of firms are state-owned (20 out of 86). In addition, our data show that almost all of the firms that have offshored manufacturing to high-cost countries are large firms, only a small handful firms are SMEs (3 out of 86). Our data indicate that the most common motivational factors for Chinese firms to offshore manufacturing to high-cost countries are expanding to new market in/from host countries, avoiding trade barriers, availability of technology, skilled labor and raw materials in host countries, as well as the made-in effect. Other factors such as home country consumers' demand, proximity to clients in host countries and host country government incentives also prevail.

Publication year

Figure 1 presents the publication year of the data sources used in our research.

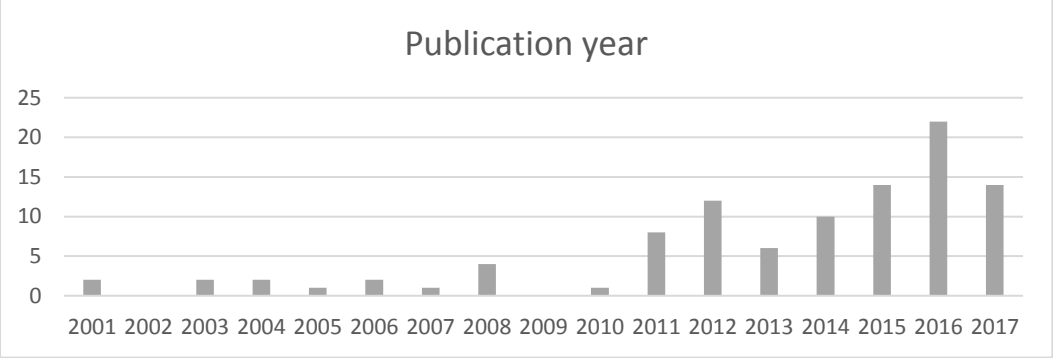

Figure 1. Publication year of the data sources

Our data was retrieved from newspapers and magazines published since 2001. From the figure, we can see a clear increasing trend of more Chinese firms that offshore manufacturing to high-cost countries from 2001 to 2017.

Host countries

Breakdown by host country locations (Figure 2) reveals that EU countries and North America are the two most significant areas represented in our sample (respectively around 46 percent and 43 percent). Other than EU and North America, Developed Asia and Pacific is also featured.

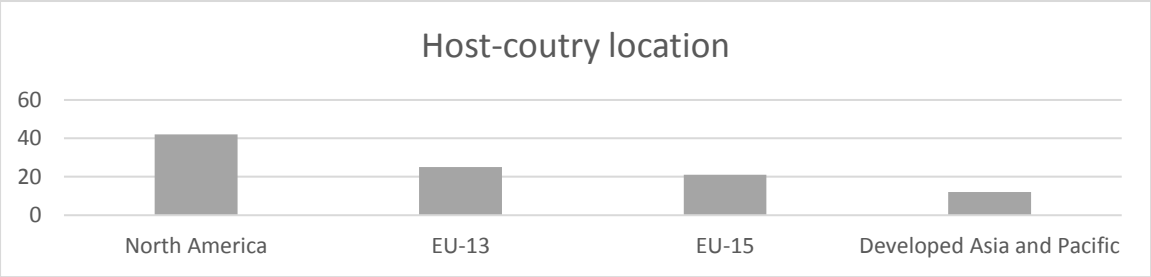

Figure 2. Host countries in which Chinese firms offshore their manufacturing

North America – Industries and motivational factors

Figure 3 presents the industries in which Chinese firms offshore their manufacturing in North America. Figure 4 shows the motivational factors for Chinese firms to offshore their manufacturing to North America.

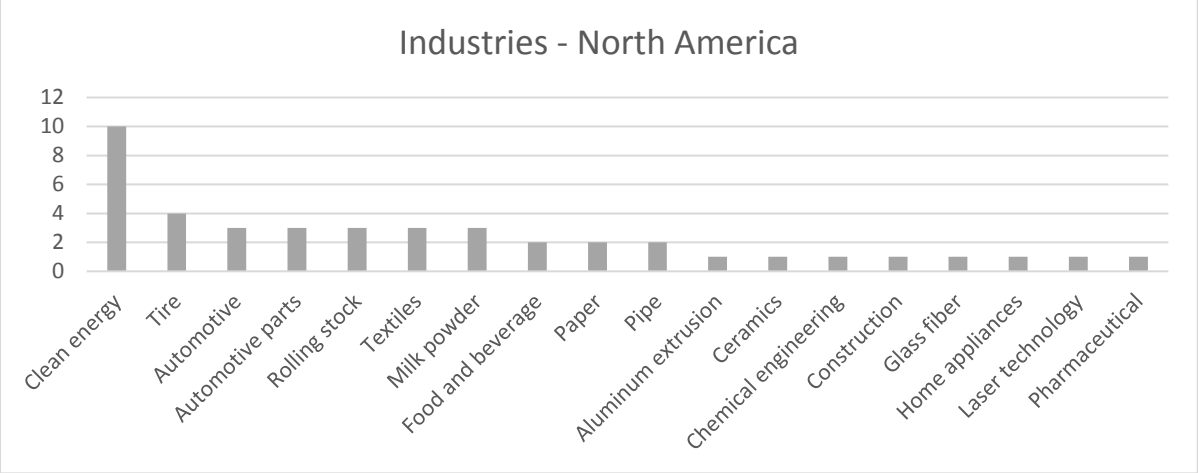

Figure 3. Chinese offshoring firms in North America by industry

The most significant industries in which Chinese firms offshore their manufacturing to North America are: *clean energy* (10), *tire* (4), *automotive* (3), *automotive parts* (3), *rolling stocks* (3), *textiles* (3), and *milk powder* (3).

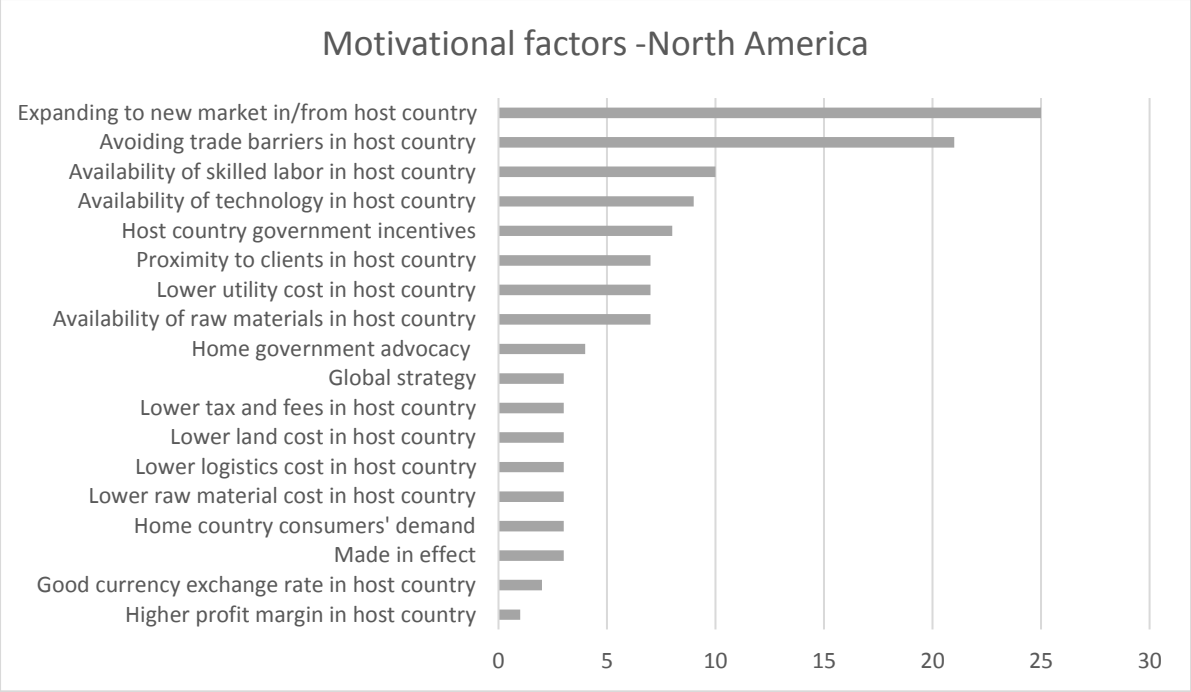

Figure 4. Motivational factors for Chinese firms to offshore manufacturing to North America

The most significant motivational factors for Chinese firms to offshore manufacturing to North America include: *expanding to new market in/from host country* (25), *avoiding trade barriers in host country* (21), *availability of skilled labor in host country* (9), *host country government incentives* (8), *availability of technology in host country* (8), *lower utility cost in host country* (7), and *proximity to clients in host country* (7).

EU-15 – Industries and motivational factors

Figure 5 presents the industries in which Chinese firms offshore their manufacturing to EU-15. Figure 6 shows the motivational factors for Chinese firms to offshore their manufacturing to EU-15.

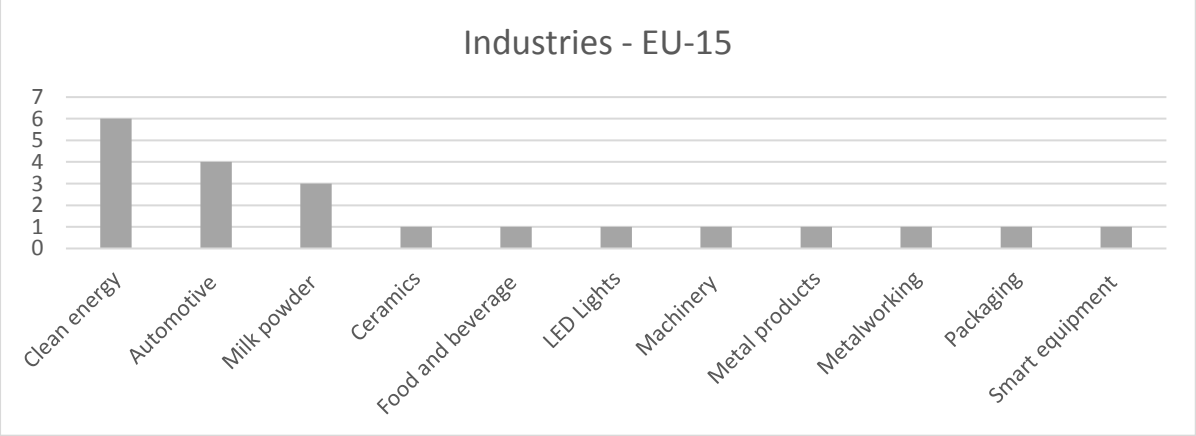

Figure 5. Chinese offshoring firms in EU-15 countries by industry

Within the EU-15 countries, the most important industries Chinese firms offshore manufacturing to include *clean energy* (6), *automotive* (4), and *milk powder* (3).

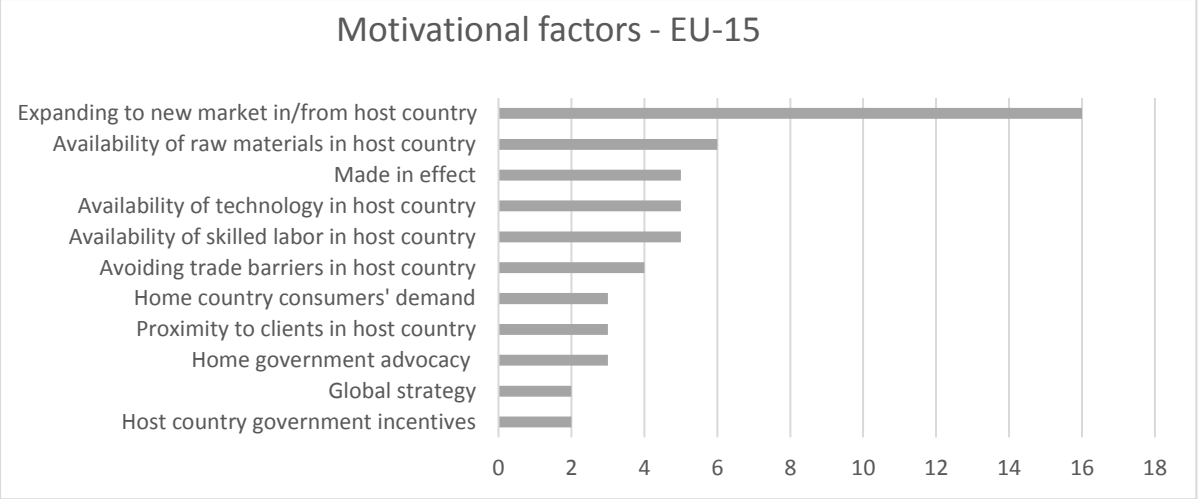

Figure 6. Motivational factors for Chinese firms to offshore manufacturing to EU-15

Motivational factors of *expanding to new market in/from host country* (16), *availability of raw materials in host country* (6), *availability of technology in host country* (5), *availability of skilled labor in host country* (5), and *made-in effect* (5) are the most occurring for EU-15 countries.

EU-13 – Industries and motivational factors

Figure 7 presents the industries in which Chinese firms offshore their manufacturing to EU-13. Figure 8 shows the motivational factors for Chinese firms to offshore their manufacturing to EU-13.

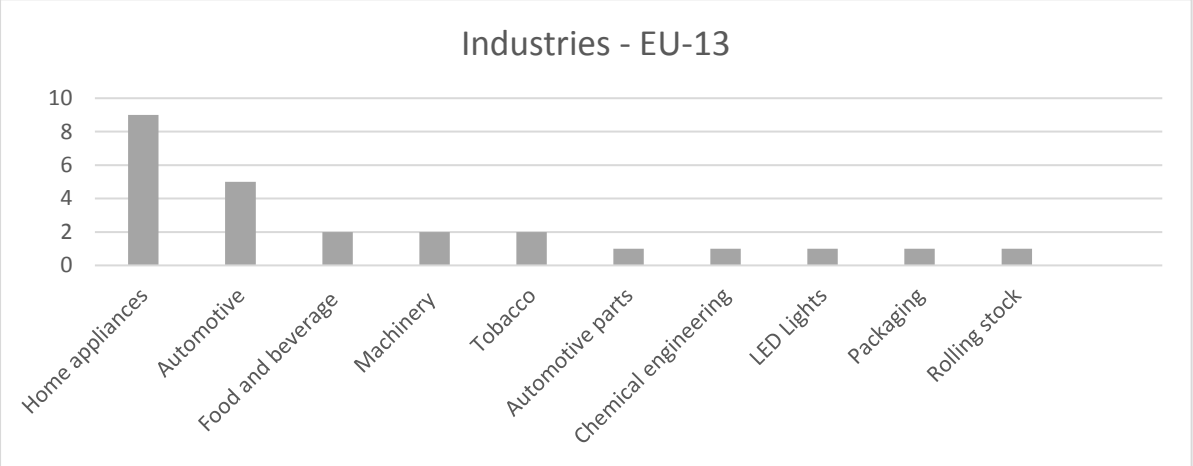

Figure 7. Chinese offshoring firms in EU-13 countries by industry

The industries of *home appliances* (9), *automotive* (5), *food and beverages* (2), *machinery* (2) *and tobacco* (2) are among the most popular for Chinese firms that offshore their manufacturing.

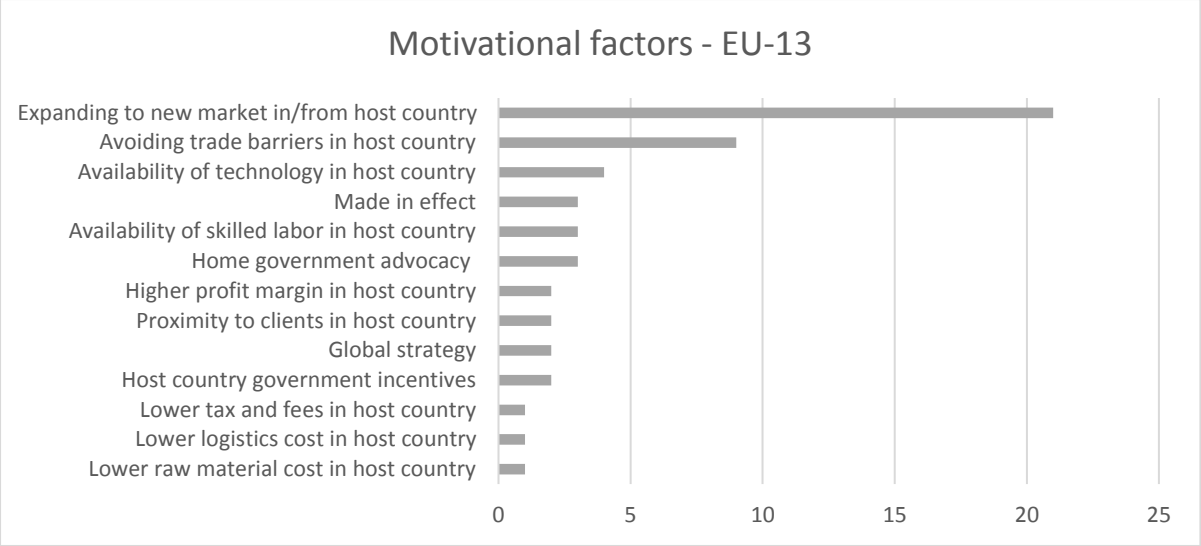

Figure 8. Motivational factors for Chinese firms to offshore manufacturing to EU-13

For the EU-13 countries, Chinese firms are motivated most by the following factors: *expanding to new market in/from host country* (21), *avoiding trade barriers in host country* (9) and *availability of technology in host country* (4).

Developed Asia and Pacific – Industries and motivational factors

Figure 9 presents the industries in which Chinese firms offshore their manufacturing in Developed Asia and Pacific. Figure 10 shows the motivational factors for Chinese firms to offshore their manufacturing to Developed Asia and Pacific.

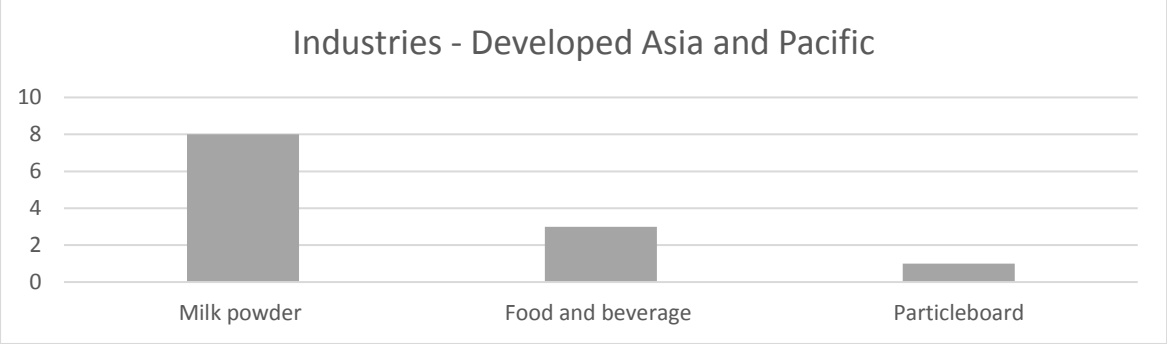

Figure 9. Chinese offshoring firms in Developed Asia and Pacific countries by industry

Chinese firms offshore their manufacturing to Developed Asia and Pacific countries are within the following three industries: *milk powder* (8), *food and beverage* (3), and *particleboard* (1).

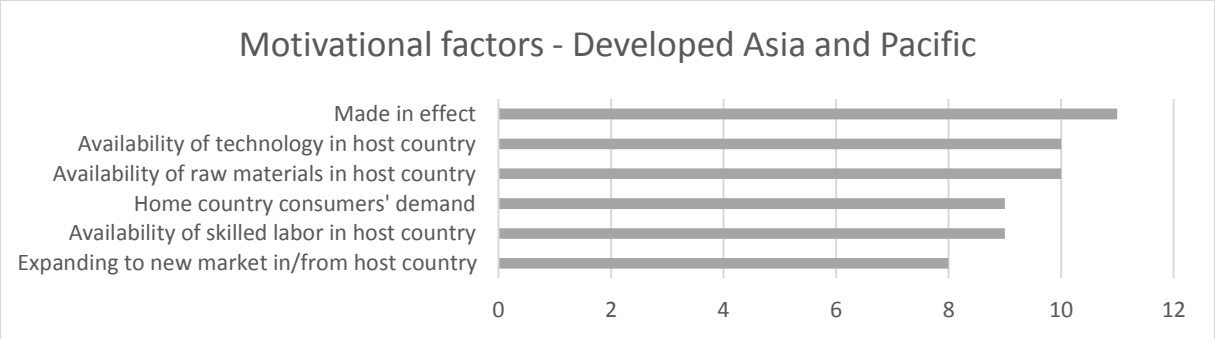

Figure 10. Motivational factors for Chinese firms to offshore manufacturing to Developed Asia and Pacific

Offshoring manufacturing to Developed Asia and Pacific countries by Chinese firms are motivated especially by the following factors: *made-in effect* (11), *availability of raw materials in host country* (10), and *availability of technology in host country* (10).

An interpretive classification framework for offshore manufacturing from low-cost countries to high-cost countries

An interpretive theory-based classification framework is depicted in Table 2. Since eclectic theory's location advantages mainly concern host country-specific advantages, we incorporate also home country aspect in our framework to better explain the motivational factors resulted from our study.

Table 2. An interpretive theory-based classification framework

Motivational factors	
Home country	• Home government advocacy (10) • Home country consumers' demand (14) • Lack of domestic need (2) • Appreciation of RMB (2)
Host country	Resource seeking advantage: • Availability of raw materials (22) Market seeking advantage: • Expand to new market (70) • Proximity to customers (12) Efficiency seeking advantage: • Host country government incentives (12) • Avoid trade barriers (34) • Lower utility cost (7) • Lower raw material cost (4) • Lower land cost (3) • Lower tax and fees (4) • Lower international transportation cost (4) • Higher profit margin (3) Strategic asset seeking advantage: • Availability of technology (27) • Availability of skilled labor (26) • Made-in effect (21)

Discussion

From the data and interpretive framework provided above, it is evident that the motivational factors for Chinese firms to offshore manufacturing to high-cost countries are dynamic, and those factors vary across different locations. Underpinned by the eclectic theory, we developed the interpretive theory-based classification framework above to categorize and interpret the motivational factors identified in our study. By comparing our study results to the eclectic theory, we identified characteristics and patterns of Chinese manufacturing offshoring decisions. This study contributes to manufacturing location decision, manufacturing offshoring, and reshoring literature by better understanding a novel and contemporary phenomenon—manufacturing offshoring from low-cost country to high-cost countries. Below, we will discuss in detail the implications of this study from both theoretical and practical perspectives.

Home-country specific motivational factors: home country advocacy and incentives

While Dunning's eclectic theory focuses on host country-specific advantages, our study results indicate the important role that home country, especially the government, plays in Chinese firms' manufacturing offshoring location decisions. Home country managers should follow closely the trend and changes of government policies.

Economic reform and government policies have historically had fundamental impact on Chinese state-owned enterprises (SOEs) (Girma, Gong and Görg, 2009). One unique feature of Chinese offshoring is the government's role in motivating firms to manufacture abroad, and the influence is especially evident with SOEs. Ten cases in our study, all from SOEs, indicate the importance of the "Belt and Road Initiative" (一带一路) and "Go Global" strategy (走出去) in facilitating their manufacturing location decisions. The Silk Road Economic Belt and the 21st-Century Maritime Silk Road, better known as the Belt and Road Initiative, was proposed in 2013 by Chinese central government, aiming at promoting economic prosperity and fostering cooperation among pan-Eurasian countries (Belt and Road Portal, 2017). Implemented in 2001, "Go Global" strategy acts as a proactive part of China's new opening-up strategy (The State Council of the People's Republic of China, 2017). Although government initiative is not a novel factor in manufacturing location studies, Mann (2012) for instance emphasizes governments' contribution to improve a country's competitiveness and attractiveness, government that encourages firms to engage in manufacturing activities beyond home country's border is rather new to manufacturing location literature. This can be partially seen from Chinese outward FDI, which showed an upward trend since China's opening-up reform in the 1980s, reaching the historical highest point at USD 183,100 million in 2016 (UNCTAD, 2017). The Chinese phenomenon echoes Dunning (1998)'s statement that "the renaissance of the market economy, and the consequential changes in the macroeconomic policies and macro-organizational (micro-management) strategies of many national governments" have had a profound effect on the geography of MNEs.

Host-country specific motivational factors: host country government incentives

On the other hand, our results (12 cases) suggest that host governments' incentives have also influenced Chinese firms' foreign investment decisions, which is similar as the reshoring motivation of national subsides for relocation (Tate, 2014). These incentives include tax reduction, subsidies, and supportive policies. From host governments' perspective, Chinese investments will create employment opportunities and assist local economic growth.

"This new factory brings opportunities…I expect that the business will do well, and bring more fortune and employment to Spain." (Spanish local official, Xinhua News, 2015)

Cost factors

Cost factors have been a main concern for both offshoring and reshoring decisions (Kinkel and Maloca, 2009; Tate, Ellram, Schoenherr and Petersen, 2014). In eclectic theory, cost-related factors represent the most significant influence on location decisions (Dunning, 1980). The overall logic is that companies from developed economies move production to developing countries where costs are lower, and manufacturing investments from developing countries go to other developing countries with even lower costs (Dunning, 1998). China, as a developing economy, has been traditionally perceived as destination of low-cost production (Fang, Gunterberg and Larsson, 2010). To our surprise, a great number of our cases suggest that manufacturing in particular developed countries such as the USA can actually help firms reduce costs. This perhaps echoes the findings of high total cost of sourcing and labor costs' gap reduction as motivations for reshoring (Power, 2011; Canham and Hamilton, 2013; Kinkel, 2014; Tate et al., 2014). These reduced costs for Chinese firms might come from raw material

cost, land cost, utility cost, tax and fees, and international transportation costs. Despite the relatively higher labor cost, Chinese firms are convinced that the accumulated cost savings from other categories would exceed the extra labor cost.

"The land is basically free, energy costs are much lower than in China, electricity price is half, and natural gas is one fifth that of China. In general, our profit in the US will be over 10% higher." (Automotive glass firm, 2016)

"Even though the labor cost is high in the US, just the raw material cotton alone, we can save RMB 7,5 hundred million (around USD one hundred million). Plus the electricity cost is less than half that of China." (Textile firm, 2013)

Expand/access to market and made-in effect

Similar as offshoring manufacturing from high-cost home countries to low-cost host countries, a major motivation for Chinese firms to offshore manufacturing to high-cost countries is expanding to new market (Dunning, 1991). However, a difference can be noted: some firms are offshoring manufacturing to a certain high-cost country not only to expand to this country, but also to other countries in the same region. For instance, many Chinese firms have offshored their manufacturing activities to relatively low-cost European countries, such as Poland (9 out of 46 EU cases) and Hungary (6 out of 46 EU cases), with the hope to gain access to the whole EU market.

"Although Bulgaria is one of the poorest countries in EU, its low-cost and geographic advantage could help Chinese firms go to European market, as it is a member of EU….We will sell in Bulgaria first, then expand to its neighboring countries such as Macedonia, and gradually to Germany." (Automotive firm, 2013).

Another relating motivation for firms from low-cost countries to offshore manufacturing to high-cost countries is because of the "made-in effect", which is similar to the motivation for some firms to reshore from low-cost countries to high-cost countries (e.g. Martínez-Mora and Merino, 2014). A noticeable example is in the Chinese milk powder industry: an estimated 300,000 babies in China got sick from contaminated domestic milk powder, and further kidney damage led to six fatalities (Jacobs, 2008). Not only did the incident damage the reputation of China's food exports, it also dealt a devastating blow to the booming Chinese dairy industry, resulting in a series of mergers and consolidations and making the 2008 incident one of the largest food safety scandals in PRC history (Huang, 2014). Chinese consumers have lost confidence in the Chinese domestic milk powder industry, and to offshore manufacturing from China to countries that consumers regard as "reliable milk producing countries", such as Australia and New Zealand (Luo, 2011), Chinese firms in the dairy industry could regain their consumers in their domestic market.

"Since 2008, Chinese consumers have lacked confidence in domestic milk powder brands, while at the same time; they blindly trust milk powder products from abroad." (Dairy firm A, 2017)

On the other hand, consumers from other countries might also prefer products manufactured in developed countries than made-in-china products, as made-in-china products are often perceived as having poor quality (The Economist, 2009). Due to this reason, some Chinese firms are offshoring manufacturing to high-cost countries to eliminate the "made-in-china" effect, so as to also attract consumers from other countries.

"With milk source and technology from New Zealand, not only can we expand our market in China, but also we can enter the international market, and lay a foundation for our strategy in Southeastern Asia and the Middle East." (Dairy firm B, 2016)

Avoiding trade barriers

Many developed countries have imposed anti-dumping and anti-subsidy duties on certain products imported from China (Brown, 2010), in order to avoid such trade barriers, Chinese firms in certain industries, such as solar photovoltaic, tires and home appliances, are motived to offshore their manufacturing activities to countries that are not affected by such duties.

"[To avoid trade barriers] our production capacity in China needs to be transferred somewhere else, so we started a factory in Chicago in 2010, and that is our solution to anti-dumping and anti-subsidy duties imposed by US." (Solar photovoltaic firm, 2014)

Availability of skilled labor, technology and raw material

Similar as offshoring manufacturing from high-cost countries to low-cost countries, availability of skilled labor, technology and raw materials (Dunning, 1991; Lewin, Massini and Peeters, 2009) is an important factor for Chinese firms to offshore manufacturing to high-cost countries.

"Not only is US one of the biggest producing and consuming countries for glass fiber, but also US is the biggest overseas market for us. At the same time, US has the highest industrialization level of glass fiber, the biggest market, and abundant talent pools. In addition, US also has abundant and excellent energy resources and mineral resources." (Glass fiber firm, 2016)

Other remark: failure and bankruptcy

Despite the many benefits that motivate Chinese firms to go abroad, risks coexist with opportunities. During the follow-up searches, we noticed that out of the 101 cases, five cases from four different firms ended up with bankruptcy. These unsuccessful cases include two clean energy firms that moved production to the USA and Italy, one canned food manufacturer in Czech Republic, and one automotive manufacturer in Bulgaria. Reasons for the bankruptcies are multi-faceted. Solar panel manufacturer firms declared bankruptcy partially due to the declining prices for solar products globally resulting from overcapacity and high tariff for components imported from China. The canned food manufacturer started production in Czech Republic because the brand was known among Eastern European consumers in the 1970s, but it could not challenge local competitors' market position when commercial products are much more available today. The automotive firm were not able to produce cars with quality that meets the EU standards, and the price was not competitive enough. In general, host government policies towards FDI in certain industries, lack of knowledge of host market, and insufficient quality are the major causes for the failure of Chinese manufacturing in high-cost countries. Managers should be aware of the potential risks and conduct comprehensive market analysis before engaging in offshoring activities.

Conclusion

In this research, we made an attempt to understand the motivations for firms from low-cost countries to offshore manufacturing to high-cost countries by analyzing 101 cases extracted from newspaper and magazine sources. Based on the data set, we built a classification framework derived from eclectic paradigm. This paper contributes to the literature streams of offshoring and manufacturing location decision, and it provides managerial implications for firms from low-cost countries on why they might need to offshore manufacturing to high-cost

countries. However, this research is not without limitations: first, we only studied Chinese firms' motivation to offshore manufacturing to high-cost countries, as our data did not include firms from other low-cost countries. Secondly, our data comes from newspaper and magazine sources, while media coverage might have a preference on certain types of firms, e.g. well-known large firms, and certain host countries, e.g. USA. Future studies investigating firms from low-cost countries' offshoring to high-cost countries could involve first-hand data from sources such as surveys and interviews, and examine why some of the firms' offshoring succeeded while some others failed. Additionally, future research could attempt to identify and analyze the different types and strategic roles of foreign factories (Ferdows, 1997) that Chinese firms have established in high-cost countries. Finally yet importantly, longitudinal studies following the trend and shift of the phenomenon could be helpful.

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Purchasing Professionals' Performance: Literature-driven Research Model and Empirical Test

Bernd Markus Zunk [a *], Volker Koch [a], Klaas Stek [a, b], Holger Schiele [b]

[a] *Graz University of Technology, Kopernikusgasse 24/II, 8010 Graz, Austria*
[b] *University of Twente, Drienerlolaan 5, 7522 NB Enschede, The Netherlands*

[*] *Corresponding author bernd.zunk(at)tugraz.at*

Summary

For purchasing managers it is difficult to assess the individual of purchasing professionals' contribution working in buying centers to the overall department's performance. As literature mainly focuses on purchasing department's performance this work-in-progress paper aims to present a basic research model focusing on the purchasing professional individual performance. The data to test the presented basic research model applying reliability as well as factor analysis stem from 82 responses obtained from an online survey sent personalized to purchasing professionals of firms in Austria. The results validate the proposed model and may help to support the purchasing department's management control system.

Keywords: Purchasing Professionals, Performance, Measurement

Submission Category: Working paper

Introduction

The high potential of the purchasing function to increase efficiency and effectiveness of firms and thus to pursue important business objectives and form sustainable buyer-supplier relationships is widely reported in literature (Cousins, 2002; Eßig et al. 2013). In practice, both the buyer-supplier relationship management as well as the purchasing success itself are determined by buying centers integrated in purchasing departments and thus by each individual purchasing professional. However, management control systems for purchasing departments and subsequently for purchasing professional individuals have been neglected both in theory and practice (Hofmann et al., 2012; Lardenoije et al. 2005). Therefore, this work-in-progress paper aims at the conceptualization and initial validation of a basic research model by answering the following guiding research question: *Which factors describe the individual performance of purchasing professionals?* To answer this question a short overview on the theoretical background as well as the relevant literature is provided in the next section. Based on this, seven factors which may facilitate the description of the purchasing professionals' individual performance are identified and put together in a basic research model incorporating four operational and three strategic factors. In a further step the research design including the measures applied for developing our key construct – the purchasing professionals' individual performance, the survey instrument and the sampling process – are presented. The results section states the findings obtained from the data analysis and, consequently, the test of the introduced basic research model. The concluding section outlines and discusses the findings, refers to limitations of this study and carves out directions for future research.

Theoretical Background

In practice purchasing performance is accepted as an important determinant of a firm's competitive advantage. Research has already shown that the efficiency and effectiveness of purchasing departments (Bals and Turkulainen, 2017) depend on the education, motivation, skills, experience of their purchasing professionals, the incentive systems in firms as well as the dynamics between members of buying centers (Nollet et al., 2017; Price and Harrison, 2009; Walker et al., 2012). The motivation of each individual purchaser helps organizations to survive and prosper (Frey and Jegen, 2001) and to develop in a sustainable way (Busse, 2016; Knight et al., 2017; Mogre et al., 2017; Patala et al., 2016; Rahman and Islam, 2017). In order to increase the individual's motivation it is necessary to build systems that enable purchasing managers to control the purchasing departments and the purchasing professionals' individual performance. However, there is lack of measurability of individuals purchasing success, which makes it difficult for purchasing managers to implement a performance-based system in purchasing departments (Jääskeläinen and Thitz, 2018; van Weele, 1984). According to Pagell et al. (1996), this is due to the difficult and manifold measurement models (Lima-Junior and Carpinetti, 2017) of the factors describing the performance of purchasing professionals. To solve this problem, specific factors (key performance indicators) that are both (i) easy to communicate to employees and (ii) measurable have to be (1) identified (Table 1) and (2) operationalized (Table 2). The basic research model displayed in Table 1 incorporates seven factors (divided into four operational and three strategic factors). These factors were derived from empirical research driven literature. Accordingly, Giunipero (1990) suggests measuring the effectiveness of the purchasing function on the basis of its ability to manage delivery, suppliers' quality as well as lead time and the ability to control the total acquisition cost. Chao et al. (1993) apply ten measures (quality, on-time delivery, commodity knowledge, accuracy, professionalism, negotiating ability, Purchase-Order cycle time, target cost, cultivate supplier, teaming). Shin et al. (2000) deploy five measures to model buyer performance (product performance, product features, product reliability, product conformance, product durability). Krause et al. (2001) use cost, quality and delivery measures to operationalize purchasing performance. Wen-li et al. (2003) propose supplier performance improvement and supplier's contribution to a buying firm's competitive advantage as two dimensions of purchasing performance of a buying firm. Terpend et al. (2011) regard purchasing performance as a composite of innovation performance, quality, cost, delivery, flexibility and purchasing efficiency. Caniato et al. (2012) use six categories (cost, time, quality, flexibility, innovation, sustainability) to measure purchasing performance. In this context, the findings of Hüttinger et al. (2012) make it reasonable to add the supplier satisfaction construct to the conceptualization of the purchasing professionals' individual performance measure. Foerstl et al. (2013) define the performance of the purchasing and supply management function in terms of price savings, total cost, quality, lead times and contribution to purchased items. Nair et al. (2015) present a five-part multi-perspective research model consisting of operational and strategic measures (cost, quality, delivery and flexibility, performance, innovation). Based on this and by adding strategic and operational management perspective (Gälweiler and Malik, 2005), Table 1 displays the final selection of factors (constructs) which should enable the description of the purchasing professionals' individual performance.

Table 1: Basic Research Model

		Factors (Constructs) Describing the Purchasing Professionals Performance
Purchasing Professionals Individuals Performance	Operational	Cost Optimization
		Quality Improvement
		Delivery System Support
		Process Flexibility
	Strategic	Innovation Orientation
		Supplier Satisfaction Contribution
		Purchasing and Supply Management (PSM) Integration

Research Design

Sampling

To test the basic research model describing the purchasing professionals' individual performance, data were collected from a large-scale on-line survey. For this purpose an online questionnaire was designed and sent out to purchasing professionals. For the online survey the sample frame was drawn of the "Federation of Materials Management, Purchasing and Logistics in Austria" (BMÖ) which represents a total population of about 1,600 purchasing professionals among all industries in Austria. Following the guidelines of Bethlehem (2010) and Sax et al. (2003), the final instrument was sent via e-mail to all of the approximately 1,600 purchasing professionals of the BMÖ member list. About 950 e-mail addresses were not valid which resulted in a reduction of the sample to 650 potential participants. The mailing package consisted of a cover letter and a link to the questionnaire in LimeSurvey. A first e-mail reminder addressed the 650 valid e-mail addresses of the BMÖ members after two weeks and a second reminder was sent after four weeks. Participating respondents were offered a summary report as an incentive. This resulted in a total of 82 responses, excluding returns, refusals and unusable responses. It represents a response rate of 12.62%. Only complete responses were included in the data analysis. The data collected was used to analyze the basic research model applying a confirmatory factor analysis as well as a reliability analysis. The profile of the sample is structured as follows: 81.71% of the study participants are male and 18.29% female. 67.07% are aged between 30 and 49. 57.32% of the responding persons have a third level education (PhD, MBA, bachelor degree, college education) while 86.59% have already continuous work experience of more than 5 years in the field of purchasing. 31.71% of the respondents are engaged in operational purchasing functions, 20.73% of the responding purchasers play a role as members of staff in strategic purchasing functions and 47.56 % of the respondents hold a management position (senior manager, purchasing manager, chief buyer, executive director, buying director). The purchasing volume participating purchasers are responsible for is averaging 50 Mio. EURO and can be broken down as follows: 9.76% investment goods, 9.76% services, 15.85% mass products, 26.82% serial products, 29.72% individual products (project purchasing) and 8.54% others. No significant differences could be found in the responses when controlling for gender, age, education, firm size, work experience or hierarchical levels in purchasing departments.

Instrument Development and Measures

The constructs as well as item measures for the purchasing professionals' individual performance were adopted from purchasing and operations management literature (Table 2) and built from existing scales and conceptual works (Table 2). Item scales were graded on a 7-

point Likert-scale (1= strongly agree, 7= strongly disagree). Preliminary to the online survey, a pre-test was developed and pilot-tested among four senior-level purchasing and three junior-level managers as well as four academics in the field of purchasing and supply management. Feedback was also obtained for other aspects such as completion time, instrument lengths and format. The received feedback was used to drop or add individual items and a final instrument was developed for large sample administration.

Table 2: Operationalization of the Factors (Constructs)

	Factors (Constructs)	Items	Referring to
Operational	**Cost Optimization**	Purchasing performance in reducing cost of inputs.	(Nair et al. 2015)
		Purchasing performance in reducing cost of purchasing activities.	
		Purchasing performance in exploiting the ability and willingness of the supplier to share data cost.	(Terpend et al. 2011)
	Quality Improvement	Purchasing performance in improving the quality of inputs.	(Nair et al. 2015)
		Purchasing performance in improving the quality of outgoing products.	
		Purchasing performance in increasing standardization of inputs.	
	Delivery System Support	Purchasing performance in reducing the procurement cycle time.	(Nair et al. 2015)
		Purchasing performance in improving the on-time deliveries.	
		Purchasing performance in increasing inventory turns.	
		Purchasing performance in increasing percentage of Just-In-Time suppliers.	
	Process Flexibility	Purchasing performance in responding quickly to design changes.	(Nair et al. 2015)
		Purchasing performance in responding quickly to requirements arising out of changes in production volumes or schedules.	
		Purchasing performance in responding quickly to the integration of new suppliers in the purchasing process.	* added by Authors
Strategic	**Innovation Orientation**	Purchasing performance in gaining access to new technologies.	(Nair et al. 2015)
		Purchasing performance in participating in product development project/efforts.	
		Purchasing performance in exploiting the ability of suppliers to design new products or make changes in existing items.	(Terpend et al. 2011)
	Supplier Satisfaction Contribution	Purchasing performance in technical excellence by involving suppliers early in the value creation process of the own company.	(Hüttinger et al. 2012)
		Purchasing performance in investing in supplier value and having long-term time horizons.	
		Purchasing performance in finding the adequate mode of interaction (communication).	
		Purchasing performance in operational excellence in forecasting and planning.	
	Purchasing and Supply Management (PSM) Integration	Purchasing performance in an active contribution of PSM to supply base knowledge and supplier innovations to optimize cost and customer value of new products.	(Foerstl et al. 2013)
		Purchasing performance by involving PSM in all important manufacturing value creation considerations such as “make vs buy”, lean operations and vertical integration.	
		Purchasing performance of PSM in an active exploitation of the supply base opportunities to provide access to new markets, new customers, and new products.	

Results

To validate the basic research model, confirmatory factor analysis (CFA) was used. As an initial step the Kaiser-Meyer-Olkin (KMO) Test was carried out to test how suited the collected survey data is for factor analysis. The KMO value of 0.802 indicates that the sampling is adequate. An exploratory factor analysis (EFA) preceded the CFA and showed an acceptable corrected inter-item correlation of > 0.4 (Bühl, 2016) for all 23 items displayed in Table 2. The results of the CFA show that all items load significantly ($p < 0.05$) on their hypothesized factors (constructs). The reliability of the latent variables was assessed by applying Cronbach's alpha and composite reliability values (Fornell and Larcker, 1981). The Cronbach's alpha values of the seven factors (constructs) suggest acceptable reliability for each of the scales. Table 3 presents the results obtained from the reliability analysis and the CFA. Discriminant validity was evidenced at acceptable levels by means of an examination using chi-square difference test (chi-square = 1234.992; df = 253). The item loadings as well as the overall model fit resulting from CFA provide strong evidence of convergent validity and unidimensionality (Bagozzi et al., 1991) for the 23 item measures underlying the seven factors (constructs) divided into four operational factors (Cost Optimization, Quality Improvement, Delivery System Support, Process Flexibility) and three strategic factors (Innovation Orientation, Supplier Satisfaction Contribution, PSM Integration). A potential source for bias of survey data lies in the subjective nature of the survey method. Miller et al. (1997) suggest overcoming this issue of subjective data by fulfilling two criteria: (i) Potential respondents are motivated to provide accurate data and (ii) questions within the survey instrument do not require recall data from distant past. In the recent survey and data collection both criteria were met by (i) ensuring the confidentiality of responses and providing a free-of-charge report or the core findings as an incentive for participation, (ii) focusing the questions solely on ongoing PSM processes in the focal firm the participant is employed at.

Table 3: Construct Measures, Validity and Reliability

	Factors (Constructs)	Items	Standardised item loading
Operational	**Cost Optimization** (Cronbach's α = 0.836)	Purchasing performance in reducing cost of inputs.	0.838*
		Purchasing performance in reducing cost of purchasing activities.	0.836*
		Purchasing performance in exploiting the ability and willingness of the supplier to share data cost.	0.700*
	Quality Improvement (Cronbach's α = 0.714)	Purchasing performance in improving the quality of inputs.	0.604*
		Purchasing performance in improving the quality of outgoing products.	0.764*
		Purchasing performance in increasing standardization of inputs.	0.774*
	Delivery System Support (Cronbach's α = 0.886)	Purchasing performance in reducing the procurement cycle time.	0.866*
		Purchasing performance in improving the on-time deliveries.	0.826*
		Purchasing performance in increasing inventory turns.	0.783*
		Purchasing performance in increasing percentage of Just-In-Time suppliers.	0.762*
	Process Flexibility (Cronbach's α = 0.872)	Purchasing performance in responding quickly to design changes.	0.836*
		Purchasing performance in responding quickly to requirements arising out of changes in production volumes or schedules.	0.813*
		Purchasing performance in responding quickly to the integration of new suppliers in the purchasing process.	0.739*

Strategic	**Innovation Orientation** (Cronbach's α = 0.903)	Purchasing performance in gaining access to new technologies.	0.856*
		Purchasing performance in participating in product development project/efforts.	0.915*
		Purchasing performance in exploiting the ability of suppliers to design new products or make changes in existing items.	0.824*
	Supplier Satisfaction Contribution (Cronbach's α = 0.806)	Purchasing performance in technical excellence by involving suppliers early in the value creation process of the own company.	0.613*
		Purchasing performance in investing in supplier value and having long-term time horizons.	0.786*
		Purchasing performance in finding the adequate mode of interaction (communication).	0.849*
		Purchasing performance in operational excellence in forecasting and planning.	0.642*
	Purchasing and Supply Management (PSM) Integration (Cronbach's α = 0.858)	Purchasing performance in an active contribution of PSM to supply base knowledge and supplier innovations to optimize cost and customer value of new products.	0.841*
		Purchasing performance by involving PSM in all important manufacturing value creation considerations such as "make vs buy", lean operations and vertical integration.	0.719*
		Purchasing performance of PSM in an active exploitation of the supply base opportunities to provide access to new markets, new customers, and new products.	0.816*
KMO = 0.802 Chi-square = 1234.992 df = 253 * Significant at $p < 0.05$			

Conclusion

In practice, individual members of purchasing departments consider themselves to be an operational performance-boosting as well as a strategic value-adding player within a firm's purchasing function. The present work-in-progress paper addresses this practitioner's view by providing a literature-driven identification of factors describing the purchasing professional's individual performance. This allows for the consideration of either a purchasing professional's individual or a purchasing manager's perspective on purchasing performance. When monitoring the overall performance, actions, attitudes and competencies of purchasing professional individuals can be taken into account for management control systems of purchasing departments. Based on the results from analyzing the data for Austrian firms, a purchasing professional's individual performance measurement model should contain strategic and operational factors. The test of the basic research model contributes to the existing body of literature by validating that "Cost Optimization", "Quality Improvement", "Delivery System Support" and "Process Flexibility" as operational constructs and "Innovation Orientation", "Supplier Satisfaction Contribution" and "PSM Integration" as strategic constructs might be appropriate measures to operationalize, assess and control purchasing professional's individual performance. Thus, the contribution of this paper is two-fold: the results of the study (i) add knowledge to the existing literature on purchasing performance measurement of departments regarding the purchasing professional individuals' performance; (ii) help purchasing managers with the design of a management control system that is able to evaluate the contribution of purchasing professional individuals to the operational and strategic performance of the department.

A work-in-progress paper as this one in its current status has, of course, several limitations. Firstly, the presented literature overview is too narrow and needs to be extended. Secondly, the presented literature review methodology needs to be done and reported in greater detail. Thirdly, the reshaping of the data analysis might help to carve out the core idea of focusing on a personal level instead of an organizational firm level. Fourthly, only data from Austrian firms were used in the data analysis. Therefore, it is not given that these findings will hold true in other geographical contexts and in specific lines of business. Fifthly, our study has limitations associated with perceptual measures of performance. Finally, the basic research model was built on literature and studies that report a status-quo of the last years. By considering the high dynamics of the business environment in the model building process phenomena such as environmental performance, operational risk or the risk caused by the change of the work attitude of individuals of the generations Y and Z entering the job market, value might be added to this kind of research. Referring to further research projects this working paper including its limitations might serve as a collection of ideas for an updated and refocused in-depth study of the purchasing performance construct that would be vitally important for empirical research applying partial least squares (PLS) path modelling. Regardless of all the mentioned limitations the presented study is one that comprehensively considers strategic and operational dimensions of purchasing professional individuals' performance in a basic theoretical framework.

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