Managing the supply chain management-marketing interface
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Special issue editorial: Managing the supply chain management–marketing interface

The ability to manage the interface between supply chain management and marketing processes (SCM-M interface) has profound implications for both the processes. From a marketing perspective, being able to collaborate with the supply chain increases the ability of gathering shared distribution-side and supply-side intelligence (e.g. Vargo et al., 2010; Esper et al., 2010; Gummesson, 2008), thus increasing the ability to adopt market- and customer-oriented practices. From a supply chain management perspective, increasing collaboration with marketing process is vital to allow matching demand and supply, thus satisfying customers while increasing efficiency (Campo et al., 2000; Emmelheinz et al., 1991; Fitzsimons, 2000; Gruen and Corsten, 2007).

In today’s competitive scenario, where customers are increasingly demanding for an active role in innovation, customized approaches are dominant, thus making demand increasingly volatile, being able to manage SCM-M interface becomes more and more important. The companies that are failing to adopt a comprehensive set of tools for managing the SCM-M interface, despite they might be able to create differential advantages in one but not both of the domains, are not able to exploit the benefits of the integration (Esper et al., 2010).

It is hence clear that the SCM-M interface is becoming a critical success factor for organizations in many industries, and that business processes managing such interface require a deeper analysis and understanding, together with models and methods to foster future research.

Some years ago, we wrote a paper for BPMJ stressing how literature was falling short in proving managers with theoretical approaches, tools and best practices for such an integration (Pero and Lamberti, 2013). Over the last few years, the emphasis on the mutual impacts of marketing and SCM innovation have been increasingly an interestingly discussed by academicians with respect some paramount changes in the scenario, including the Internet of Things (Kamble et al., 2019), Industry 4.0 (Ganjil et al., 2018), omnichannel retailing (Adivar et al., 2019) and additive manufacturing (e.g. Durach et al., 2017), to name a few. Therefore, this special issue aims to move forward in the analysis and understanding of the marketing–SCM relationship, interface and dynamics, by presenting a consistent collection of papers that provide significant new insights.

Out of the whole number of submissions received, after the review process, we accepted eight papers for publication in the special issue. The papers can be grouped into two main sets, depending on the topics examined. Specifically, two papers provide insights into the main trends and socio-economical changes that affect SCM-M interface and call for a profound reflection on how companies and supply chains should tackle such changes, while the remaining six papers provide insights on the techniques, approaches, tools and frameworks companies and supply chains can put in place to manage the SCM-M interface.

In the first group of papers, Noci (2019) discusses the relevance of the dramatic changes occurring in competition and market relationships on the integration between marketing and supply chain management processes. Leveraging on the literature, the author discusses an evolutionary pattern for SCM-M interface, considering the evolution of the market to always-on, service-dominant logic. In particular, he highlights the need in this context to be market-driving, and that the marketing strategy must be associated to a reconfiguration of the supply chain for providing value for customer. This results in profound organizational
implications for marketing and supply chain management processes, and their interface, that go far beyond the simple implementation of technology. Alon et al. (2019) focus on a specific initiative that is changing the global economic landscape: China’s New Silk Road. The authors discuss the implications for European small and medium enterprises (SMEs) and Chinese importers of the initiative. The investments in logistics infrastructures results in lower barriers to goods movement; therefore, the need for both European SMEs and Chinese importers to re-organize their business in the light of this change. The paper discusses the need for European SMEs and Chinese importers to collaborate and integrate supply chain and marketing processes to reap the benefits of such initiative. In the end, the authors claim that, despite the economic relevance of the initiative, researchers and practitioners still need to reflect upon the implications for the supply chain actors in terms of business processes innovation.

In the second group of papers, the tools, frameworks and managerial approaches for putting in practice SCM-M interface are examined with different focuses and at different levels. With a focus on a single company, at a more strategic level, Brun and Karaosman (2019) investigate the link between supply chain configuration choices and customers’ features. In particular, they investigate how to include customers’ expectations in supply chain configuration decisions. Through a set of case studies in the yacht industry, the authors highlight, for instance, that companies serving emotion-oriented customers, i.e., customers characterized by providing high relevance to brand reputation, and other brands’ involvement in the final product and emotional appeal, design their supply chains to convey a direct emotional impact.

With a focus on a single company, at an operational level, Ardito et al. (2019) discuss the technological solutions that the new industrial revolution is providing to the companies for managing the SCM-M interface. In particular, this paper provides interesting information about the set of digital technologies that may enable the SCM-M integration, by showing how these solutions can support information acquisition, storage and elaboration. The discussion is supported by illustrative examples.

With a focus on the activities performed collaboratively across the supply chain, considering customer involvement, Nguyen and Harrison (2019) show the implications for process innovation and performance of the acquisition of customer knowledge and knowhow. In particular, they performed a large-scale survey to test the relationships. Interestingly, they observed that process innovation plays a mediating role in absorbing and transforming customer knowledge into performance improvement. Thus, suggesting managers to use customer knowledge into process innovation. Given the importance for performance of customer involvement, Bettiga and Ciccullo (2019) investigate how suppliers and customers are involved in co-creation initiatives within product development processes. Based on the empirical evidences of cross-industry case studies, they propose a classification of the co-creation approaches (supplier-driven, customer-driven and firm-driven) and suggest contextual variables guiding the choice of which approach to implement.

With a focus on the industrial relationships between supply chain actors, Jie and Gengatharen (2019) investigate the benefits of supply chain integration in the food retail sector. They show that information sharing and the application of lean practices can improve supply chain efficiency. Interestingly, they analyze the Australian food retail supply chain and investigate specifically SMEs. Patrucco et al. (2019) study the context variables affecting the willingness to collaborate between buyer and supplier, through an international survey on manufacturing companies. The main result is that customer relationship attractiveness has a positive impact on both the innovation and cost performance ensured by suppliers. Additionally, other the antecedents of customer attractiveness have been identified: procurement knowledge and procurement status, and proficiency of supplier collaboration and visibility.
The topics addressed cover the main challenges companies are facing nowadays and the most important issues connected with SCM-M interface. Therefore, we believe this special issue can be of interest for both the scientific community and practitioners. However, despite the wide range of topics covered and the relevance of the results obtained, some questions are still open and further research is needed in this area.

The changes in the marketplace that call for a deep innovation in marketing strategies and approaches must be accompanied by a change in the supply chain management practices and tools. The SCM-M interface plays a fundamental role in allowing the company to innovate the two processes and make the whole company moves at the same pace. We believe still there is a need of research in this area: the alignment of customers’ features (Brun and Karaosman, 2019) to supply chain configuration is the first step, but an analysis of the further structural changes to supply chain management practices is foreseen. Technology is a powerful tool in supporting SCM-M integration (Ardito et al., 2019); however, the full power of technology is expressed only when accompanied by a change in the business processes and the organization. We believe that there is still the need for understanding how SCM-M interface can be (re-)design to foster the new technologies potential.

Considering the relationships at supply chain level, the changes in the marketplace call for a stronger integration of customer into product or service innovation processes. Bettiga and Ciccullo (2019) made an interesting attempt to investigate supplier and customer involvement in the same project; however, how to reap completely the benefits of such collaboration and how to structure the interaction flows between the actors is still under-investigated.

Finally, Alon et al. (2019) suggest that, in the near future, initiatives such as the one of the China Silk Road will require companies more and more to manage SCM-M interface among countries and cultures. Therefore, we hope researchers will tackle the cultural issues and management style differences in SCM-M interface, to provide managers with theoretical support when managing multi-cultural teams.

In conclusion, we would like to thank Professor Majed Al-Mashari, Editor-in-Chief of the Business Process Management Journal for allowing us to serve as Guest Editors, all the authors that have submitted their work for this special issue, and the reviewers that have contributed to ensure the academic level of the works accepted. A special acknowledgment goes to Maria Caridi, who began this adventure with us and, along the process, decided to open a new chapter of her personal and professional life; we wish her all the best and thank for the contribution all along the first phases of this venture.

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References


Co-creation with customers and suppliers: an exploratory study

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Abstract

Purpose – Co-creation along the new product development (NPD) seems the winning approach in nowadays market. The purpose of this paper is to explore the collaboration and interaction flows between suppliers and customers in co-creation initiatives devoted to NPD.

Design/methodology/approach – After developing a classification of demand-side and supply-side involvement in co-creation along the NPD process, 13 cases of co-creation in the consumer goods industry, within the Italian context, have been analyzed.

Findings – Three patterns of co-creation have been identified: supplier-driven approach: companies co-creating with suppliers in multiple NPD phases, while involving customers only in one; customer-driven approach: companies involving customers in multiple phases, while engaging suppliers only in one and firm-driven approach: companies involving both customers and suppliers in one single phase. Further, the locus of relevant knowledge drives to different co-creation approaches.

Research limitations/implications – The work contributes to extant literature by: providing a classification of demand-side and supply-side involvement in NPD; empirically investigating the interaction flows between customers and suppliers in co-creation initiatives along the NPD; highlighting the factors potentially affecting a concurrent involvement of customers and suppliers in NPD.

Practical implications – The findings can help to efficiently and effectively design and manage the relation with both suppliers and customers in co-creation projects devoted to NPD.

Originality/value – The involvement of suppliers and customers in co-creation initiatives has been so far analyzed only separately in literature. This study opens a new stream of research, stressing how the evolution of the market, toward a more participative one, spurs the need to investigate the collaboration and interaction flows between the two actors.

Keywords Co-creation, Customer involvement, Supplier involvement, New product development

Paper type Research paper

1. Introduction

New product development (NPD) process has become more and more participative. According to the service-dominant logic (SDL) (Lusch and Vargo, 2006), customers and suppliers are both resource integrators and both are involved in the co-creation of value (Cova and Salle, 2008), through joint, interactive, collaborative and reciprocal roles in a relationship (Vargo, 2009). All actors co-create value through resource integration, in an actor-to-actor fashion (Vargo and Lusch, 2011). The locus of value creation and value extraction for a company lies in the interaction between networked, empowered and active customers (Prahalad and Ramaswamy, 2004) as well as in the integration of capabilities that suppliers can put in NPD projects (Cadden and Downes, 2013). A collaboration between all stakeholders can not only create value, but also expand and enlarge it for all participating individuals (employees, customers, suppliers) in a more win–win fashion (Ramaswamy and Ozcan, 2014). The process of co-creation, as defined by Ramaswamy and Ozcan (2014) is “the practice of developing offerings through ongoing collaborations with customers, employees, managers, and other stakeholders.” This process implies a collaboration among all stakeholders, through engagement platforms, what has been recently defined as “The co-creation paradigm” (Ramaswamy and Ozcan, 2014). This new view of the value creation process implies a passage from a resource-based view of the organization to a co-creation-based view, where resources are shared among multiple stakeholders, and from resource allocation to resource leverage, including suppliers and customers resources, to create an extended enterprise (Ramaswamy and Ozcan, 2014). The dialogue-access-risk-transparency
model (Prahalad and Ramaswamy, 2004) depicts the elements companies should develop for a successful integration, and thus co-creation, with stakeholders. For an efficient and efficacy development of a shared solution, all participants must become equal and joint problem solvers. Dialogue should be centered on issues of interest to both and should be made possible through transparency and access to information. Reflexivity of information is crucial as it enables feedback, hence dialogue, between stakeholders while access is essential to gain information about others experiences, needs, and thoughts.

Despite the potential benefits deriving from the joint involvement of all stakeholders, even a cursory review of literature (e.g. Hoyer et al., 2010; Lusch, 2011; Sunil Kumar and Routroy, 2016) would highlight that customer involvement and suppliers’ involvement in NPD have been generally analyzed separately, while much lower emphasis has been put so far in the reciprocal role of these two processes, their possible interaction and consequences. This is a severe limit to literature for a twofold reason: on the one hand, it is reasonable to assume that customer co-creation implies severe challenges to supply chains, in terms of personalization required by final customers, sometimes proposing unfeasible or complex concepts. This, of course, could be extended to the case in which co-creation is on the supply-side and generates opportunity for demand-side co-creation. Research has not provided reliable managerial guidelines to manage such a situation. On the other hand, the SDL suggests that co-creation depicts networked innovation, and that the outcome of a networked process is different from the sum of the outcomes of single processes (such as supply-side and demand-side involvement in NPD).

For this reason, in this paper, we aim to explore the mode of involvement of customers and suppliers and their mutual effect on NPD projects. More specifically, we would like to contribute to extant literature by: developing a classification of demand-side and supply-side involvement in NPD; empirically investigating the interaction flows between customers and suppliers in co-creation of the offer; analyzing the factors potentially affecting a concurrent involvement of customers and suppliers in NPD. We will perform it by analyzing 13 cases of co-creation, within the Italian context.

### 2. Literature review

#### 2.1 Co-creation with customers in the NPD

In the co-creation paradigm, the “single-inventor perspective” is replaced by a knowledge flow (inflow and outflow) among stakeholders (Bogers and West, 2012). Products, services and experiences are developed jointly by companies and their customers (Ramaswamy, 2009) through collaboration that extends beyond organizational boundaries and integrates entities external to the firm (Sawhney et al., 2005).

Co-creation can happen at different stages of the NPD process, from need analysis and idea generation to product test and launch. In the first case, companies collect information from the customers to better understand their needs. Here the customer can play the role of both voluntary or involuntary source of feedbacks and ideas for the firm, generating a reciprocal learning process (Hoyer et al., 2010; Prahalad and Ramaswamy, 2004). Companies can take advantage of this interaction to generate new offers or to modify an existing product using inputs from customers. Further, customers may be involved in the evaluation and selection of ideas among multiple alternatives; in this way, the company gives the customer decision-making power on the output of the NPD and therefore more control over the process (Hunton and Price, 1997; Ogawa and Piller, 2006). In a third stage, the customer can be an active part in product design and development integrating its resources, in terms of time, effort, skills and knowledge in business processes (Auh et al., 2007; Larsson and Bowen, 1989; Moeller, 2008). He can be finally included in the product test and in the launch of the offer to the market. In this way the customer assumes the role of “partial employee” and works for the company, providing a contribution to the improvement of business performance (Lengnick-Hall et al., 2000; Macdonald et al., 2011).
The availability of resources and time and the opportunity given by a win–win collaboration are important factors determining customers’ involvement. Above that, technical knowledge of the customer may have a great impact on the propensity to participate in these business processes (Etgar, 2008; Shin, 2007). Above the benefits of such involvement, co-creation initiatives may be also risky for firms: customer participation may increase employees’ job stress and hamper their job satisfaction (Chan et al., 2010). Alignment of cultural values between customers and firm employees could facilitate such creation of value (Chan et al., 2010). Further, co-creation may evoke negative reactions and opposition from the customers to firm proposals and initiatives and the risk of public attacks, detrimental for the company image (Gebauer et al., 2013).

2.2 Co-creation with suppliers in the NPD
In different industries, customers are not the sole co-creator of value. In industries like textiles or equipment, for example, suppliers are considered the main sources of innovation and market knowledge (Kim and Wilemon, 2002). Under other conditions, suppliers are involved early in the NPD process in order to anticipate potential problems, such as unfeasible design and contradictory specifications (Mishra and Shah, 2009). Overall, the importance of supplier integration and collaboration along the NPD process has been acknowledged in research (Cadden and Downes, 2013; Sunil Kumar and Routroy, 2016). The answers to questions about the best timing and mode to involve suppliers during the NPD process is not necessary “early” and “intensively,” it can most of all be contingent upon supplier–customer relationship (Le Dain et al., 2010). In a broader view, indeed, suppliers can bring key resources as capabilities, investments, information or ideas (Le Dain et al., 2010; van Echtelt et al., 2007).

The timing and the scope to involve suppliers in a NPD process may vary. Suppliers might incorporate their know-how from the “fuzzy front end” of the process (Kim and Wilemon, 2002) by proposing technologically advanced and technically feasible ideas, so that their capabilities are incorporated from the very beginning of the project. Suppliers can then be involved in the next phases of the NPD process (i.e. product design and development) to take decisions regarding product architecture which are connected with sourcing decisions and constraints (Le Dain et al., 2010). Moreover, in case, for example, of highly innovative products, supplier involvement can be crucial also during the production of the first item (i.e. product launch phase) to support with expertise the supervision of the first product launch embedding new ideas and expediting the process by preventing problems (Song et al., 2011). The level of design responsibility (i.e. involvement intensity) assigned to suppliers can be informal (i.e. white box involvement), formalized with a joint development (i.e. gray box involvement) or shifted to suppliers with buyers providing performance specifications (i.e. black box involvement) (Petersen et al., 2005).

Beyond the benefits of an involvement of suppliers in co-creation of the offer, it should be highlighted that several constraints and risks exist as well. A relevant constraint may be the ability to transfer knowledge between the supplier and the customer and to convert them into terms and concepts that are meaningful for the other (Cavusgil et al., 2003). The risk of knowledge spillover or losing core competencies are other inevitable consequences of transfer (Squire et al., 2008) and require a certain level of trust between the supplier and the company to enable information exchange (Inkpen, 2000). Diverse languages, cultures and coding schemes between suppliers and business customers might act as constraints (Gemünden et al., 1996), as well as the risk to become overly dependent on customers and to face higher development costs (LaBahn and Krapfel, 2000; Walter, 2003).

2.3 Joint co-creation with customers and suppliers
In both supply chain management (SCM) and marketing literature very few are the empirical contributions on the joint involvement of customers and suppliers and on a more
co-creative view of the NPD process. Researches on co-creation with customer and supplier involvement in the NPD process appear to have grown apart (Ylimäki, 2014). Most of the literature on co-creation incorporates the supplier point of view, identified with the provider of goods who are co-designed or co-produced with customers (Payne et al., 2009; O’cass and Ngo, 2012). Thus, extant research focuses on the direct interface between the offer provider and the customers (i.e. a dyadic perspective), not considering instead the upstream level (i.e. suppliers of the company having the direct interface with final customers and proposing the product development) (Ylimäki, 2014).

On the SCM side, the area of partial overlap with the topic of co-creation with customers is represented by supply chain strategy segmentation (Godsell et al., 2011). The research stream developed around this topic does not refer specifically to strategy for supplier involvement, but to the broader definition of supply chain strategy. Supply chain strategy segmentation refers indeed to a differentiation of the supply chain strategy conceptualization and developed as a result of the understanding of different customers’ expectations on the required service level (Godsell et al., 2011) and therefore of different customers’ buying behaviors (Christopher and Gattorna, 2005). Juttner et al. (2010), for example, claim that the role of companies should be to direct the unique characteristics and capabilities of suppliers toward the target customer segments, consistently with a company value proposition. A branch of this literature (e.g. Kalaignanam and Varadarajan, 2006) boosts the customer’s centric perspective even further, claiming that a supply chain strategy segmentation should be carried out on the basis of the intensity of customer involvement in the co-creation process.

Looking more specifically on supplier involvement, the focus in the literature has been on the mode, intensity and timing of integration of capabilities that suppliers can put in NPD projects (Johnsen, 2009). In particular, when it comes to the “mode” of involvement, contributions in the literature discuss the importance of the organizational solutions to facilitate it (e.g. Twigg, 1998). In defining cross-functional teams, for example, authors refer to teams comprising members of internal functions as well as external actors as suppliers and customers (Boyle et al., 2005; Koufteros et al., 2005). Nevertheless, collaboration during NPD process has been investigated separately looking at supplier involvement, customer involvement and cross-functional involvement as three separated organizational practices (Mishra and Shah, 2009). Studies on cross-functional teams grouping different functions inside the same organization focus very much on the study of the barriers to be overcome, as, for example, the silos view of internal departments (Boyle et al., 2005). Supplier and customer involvement are studied as two different determinants of good NPD performance (e.g. Mishra and Shah, 2009) and, to the best of our knowledge, just in rare cases (Koufteros et al., 2005) scholars look at possible interactions between the two. Hybrid approaches are also possible, as the alignment between “boundaries spanning” functions as purchasing and marketing and customers and suppliers, respectively (Piercy, 2009). This means involving the purchasing point of view in the customer relationship management processes led by the marketing function, as well as to involve the voice of the customers into the supplier relationship management processes led by the purchasing function (Piercy, 2009). However, despite the co-creation paradigm conceives co-creation as a mutual dependence relationship among all stakeholders, the company, customers and suppliers, a comprehensive and truly participative approach of this whole set of actors is still under-investigated.

2.4 Influencing factors for joint customers and suppliers involvement

In order to ensure so-called “seamless” activities among suppliers and customers (Juttner et al., 2010) and a joint problem-solving focus (Prahalad and Ramaswamy, 2004), the SDL literature (Lusch, 2011), the participative innovation literature (Chesbrough, 2006) and the classic literature on decision making related to innovation (Von Hippel, 1994) claim the importance to bring to a single “locus” (physically or virtually) all the needed information
and capabilities by the different parties. Moreover, Von Hippel (1994) argues that this joint decision making is influenced by the extent to which an actor has relevant information and capabilities and by the extent to which there are difficulties in transferring those information and competences, constituting key operant resources (Lusch and Vargo, 2006), to other parties involved in the decision-making process[1]. This point acquires even more relevance when this knowledge is put at stake for a “super co-creation entity.”

3. Research framework
In this work, by disentangling the concept of co-creation with both customers and suppliers, we aim to investigate how companies and their supply chain partners manage this activity in the NPD process. More specifically, we believe that enabling co-creation with customers can affect the modes and the timing of co-creation with suppliers during the NPD process, and thus should be properly designed. We also assume that knowledge and competences of suppliers and customers should be considered as a moderator factor in this relationship. We define knowledge and competences as both abstract information and techniques in the hand of the individual, according to Mokyr (2002). Looking at two different streams of literature, marketing and operation management, we derive an integrated research framework (Figure 1) to guide our exploratory analysis of the subject. In particular, as outlined in Figure 1, we concentrate our attention on the interactions flow between customers, firm and the firm’s suppliers involved in the NPD process. We posit that in order to fully exploit co-creation benefits, firms should enable a continue interaction and dialogue with both suppliers and customers along the NPD process through engagement platforms. Thus, in order to explore how co-creation processes actually take place and are interrelated we outline as a first research question:

\textbf{RQ1.} How does the integration between customer co-creation and supplier co-creation takes place along the NPD process?

The interaction flows among suppliers and customers encompass not only when and what is the contribution of suppliers or customer to the co-creation process, but also the role of the firm, the development choices made and consequent constraints imposed ahead in the NPD process and on other actors during the co-creation process. Furthermore, when problem solving related to a NPD project requires access to “sticky information” that reside in customers and/or suppliers (Von Hippel, 1994), different iterations and information flows may be needed along the co-creation process, to extract value from the diverse knowledge resources. Therefore, both customers and suppliers knowledge and competences seem

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Conceptual framework}
\end{figure}
relevant moderators when studying involvement of external actors into the NPD process. Hence, we are interested in studying:

\textit{RQ2.} Are suppliers and customers knowledge affecting the co-creation interaction flow among customers and suppliers? And how they do so?

4. Methodology

4.1 Selection of the methodology and boundaries setting

The research framework presented in the previous section outlines the main aim of our research: disentangling the concept of co-creation with multiple stakeholders, such as customers and suppliers. We aim therefore at providing answer to \textit{RQ1}, \textit{RQ2} and refining the research framework presented above getting details on the definition and operationalization of the variables involved (i.e. co-creation with suppliers and customers) and to provide external validity of this and future-related studies investigating the role of contingent factors in place. We performed exploratory multiple case studies research (Yin, 2009) in a cross-industry context (i.e. food, home appliances, fashion accessories, car products) considering both B2C and B2B context. We adopted as unit of analysis a single project of a product recently launched in the market. We decided to focus on cases within the Italian market. All the products we analyzed were incremental innovations in the market, were developed during the same time period and the NPD project (i.e. our units of analysis) have akin durations, to enable comparability of results. We indeed considered consumer goods, home appliances and a medical devices as product categories, which all share a NPD process with a duration that ranges from six months to two years.

4.2 Creating a sample frame

Our sample is composed by 11 companies that resulted in 13 embedded units of analysis (case studies). We employed a multiple case study approach to perform both an in-depth examination of each case and a cross-case comparison (Eisenhardt and Graebner, 2007) and in order to add confidence to the findings (Miles and Huberman 1994, p. 29). Case studies have been selected adopting an intensity type of sampling (Miles and Huberman, 1994, p. 28). In particular, we used intensity sampling, because this allowed us to select information-rich cases where we could find clear evidences about co-creation initiative with both customers and suppliers along a structured NPD process. The information to understand the case eligibility in the sample have been collected through an extensive secondary sources analysis by looking for specific co-creation initiatives. Table I reports general information about the sample.

<table>
<thead>
<tr>
<th>Companies</th>
<th>Turnover 2015 (M EUR)</th>
<th>No. of employees</th>
<th>Unit of analysis (co-creation initiative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>85–86</td>
<td>320</td>
<td>Leather bag and accessories</td>
</tr>
<tr>
<td>Case 2</td>
<td>31</td>
<td>65</td>
<td>Car scent</td>
</tr>
<tr>
<td>Case 3</td>
<td>4</td>
<td>10</td>
<td>Interbody cage</td>
</tr>
<tr>
<td>Case 4</td>
<td>52</td>
<td>283</td>
<td>Zipper</td>
</tr>
<tr>
<td>Case 5</td>
<td>2,000</td>
<td>3,993</td>
<td>Gluten free pasta</td>
</tr>
<tr>
<td>Case 6</td>
<td></td>
<td></td>
<td>Nuts biscuits</td>
</tr>
<tr>
<td>Case 7</td>
<td>5,600</td>
<td>24,000</td>
<td>Fridge</td>
</tr>
<tr>
<td>Case 8</td>
<td>1,136</td>
<td>3,201</td>
<td>Frozen pizza</td>
</tr>
<tr>
<td>Case 9</td>
<td></td>
<td></td>
<td>Brick of tea</td>
</tr>
<tr>
<td>Case 10</td>
<td>366</td>
<td>152</td>
<td>Vacuum drawer</td>
</tr>
<tr>
<td>Case 11</td>
<td>356</td>
<td>717</td>
<td>Homogenized meat</td>
</tr>
<tr>
<td>Case 12</td>
<td>31</td>
<td>208</td>
<td>Professional vacuum cleaner</td>
</tr>
<tr>
<td>Case 13</td>
<td>834</td>
<td>970</td>
<td>Customized bottle of beer</td>
</tr>
</tbody>
</table>

Table I. General Information about the sample
4.3 Instruments adopted and steps undertaken in the data collection

Information about the NPD project have been collected thanks to at least two semi-structured interviews. The choice of adopting a semi-structured interview protocol is explained by both the possibility to focus on the specific and unique aspects of each initiative and the possibility to ask more specific questions related to the theoretical constructs underpinning the variables chosen in our research framework. The questionnaire adopted is structured as follows: a first part is devoted to general information about the company, then the focus is moved on a specific NPD project during which there are co-creation initiatives, which had been identified. The questionnaire develops around one NPD project by asking for the different stages and milestones of the project, actors involved and coordination mechanisms adopted throughout the process. Afterwards, more in-depth questions are devoted to understand the contribution of suppliers and/or customers in the different stages, asking about modes of involvement and suppliers–company, customers–company and direct suppliers–customers interactions.

Interviews had durations ranging from a minimum of 1.5 h to a maximum of 2 h with, for most of the cases, product managers. These roles have been identified as our target interviewees, given the “end to end” perspective he or she has on the project. For other cases our informants (e.g. in Case 2) were instead marketing or brand managers, which were interviewed on the part of the questionnaire related to customers’ involvement, while, where possible, the part concerning supplier involvement was investigated in-directly involving purchasing managers as well. For one case (Case 3) we had the chance to get in contact with the head of purchasing department, who was directly involved in the co-creation project, thus sharing with us all the needed information. Interviews have been tape recorded, transcribed and coded. The transcription of the case has been sent back to our respondents in the different companies to get a validation. Some follow-up meetings and phone calls were scheduled in order to get clarifications or complete some missing parts. We triangulated data with publicly available information on the different projects under investigation, as well as through (when available) presentations on projects’ reports which were shared during some of the interviews.

5. Findings

5.1 Descriptive case analysis: co-creation initiatives by companies in the sample

Case 1 (leather bag). Case 1 is an Italian company, producing and selling collectibles and adornments with an internationally recognized brand. In the past, the company core business was restricted to ceramic products with an aesthetic function at home. Recently, the company has started to develop new product lines, such as soft toys for children and different type of accessorize made with fabrics (e.g. bags, wallets, pencil cases) and wood. Given the novelty represented by these businesses, both market and technical expertise of the company are limited and, therefore, an important role is played by suppliers.

The aim of the co-creation initiative under investigation lies in collecting new ideas about a product that has not been historically the core of the offering of the company (i.e. a leather bag), together with the preservation of brand value associated with the above-mentioned pillars of elegance and style. For this initiative, the company addressed only a restricted group of consumers (i.e. the company Club), which was considered representative of the target market and of the main values on which the company stands. The members of the company Club were therefore involved starting from the needs analysis and idea generation phase. The ideas were mainly collected through the website and in particular in a “virtual area” dedicated to members of the company Club. The ideas collected in this process had then to undergo an evaluation by a wider spectrum of customers, always through the website. Customers voted the idea that best reflects their needs. The ideas generated were
not all immediately feasible, the company decided the ones that were most reflecting the brand values and then asked for a technical feasibility assessment to suppliers to carry out the detailed design (i.e. technical drawings of the bags).

*Case 2 (car scent).* The company is an important player in the production and distribution of car care, home care and personal care products. The NPD project under investigation regards a special type of car scent, with a distinguishing design. The key feature of this design is represented by the shape of the car scent, which has an intrinsic iconic value. The co-creation initiative launched by the company indeed does not regard the shape of the car scent, but colors, style and the perfuming. The project originated from the desire of the company to consolidate its positioning in the market, in particular among younger customers. For this initiative, through a contest launched on the website of the company, customers were asked to propose new “themes” (i.e. colors and perfume) for a car scent, according to their own style and upload it on the website, where customers can also rate the different proposals posted by others to elect a short list of winners. At the end of the competition a special jury of ten people (internal and external to the company), elect the top three proposals. A key role is then played by the relationship with the subcontractor who is manufacturing the scent (the production is fully outsourced). The head of production at the subcontractor site, indeed, brings a decisive contribution to the product development process, bringing into the process the technical constraints related to the realization of new weaves or colors on the production line.

*Case 3 (interbody cage).* The company is a global medical device player which designs and commercializes industry leading products for complex spinal disorders. The main customers of the company are represented by surgeons, who either order a personalized device or provide the necessary technical competence to initiate the development of a new product that will be then inserted in the company products catalogue. Surgeons collaborate with the company for different reasons: to answer to patients’ needs, to receive recognition if the invention turns out to be successful and for business reasons. Other key actors in the NPD process are the engineers, employed by the company and responsible for the realization of prototypes and feasibility studies, based on the proposals coming from surgeons. Suppliers provide components and raw materials (i.e. steel, plastic, titanium) and they have therefor a marginal involvement in the NPD process.

The specific co-creation initiative investigated is about an interbody cage, an implant inserted in patients to treat degenerative disc disease. The idea generation phase was fully developed by a surgeon (external to the firm). Following, the surgeon and company engineers worked on the scheme of the project, developed feasibilities studies and conducted an evaluation of plastic and metal prototypes developed internally by the engineers. Finally, the product was tested by the surgeon himself and by other hospitals and specialized centers interested in the purchase of the cage that provided further feedbacks. Suppliers were involved in the definition of the specific material of the cage (steel, plastic, titanium) according to company’s specific requirements.

*Case 4 (zipper).* The company is the leading Italian manufacturer of zippers. The company manufactures all semi-finished products (tapes, sliders, etc.). In 2013, the company has embarked in different initiatives connected to the environmental dimension of sustainability (i.e.: production of zipper made from 100 percent organic cotton, zippers made from cotton derived from a milk protein, zippers made with recycled polyester). In line with these trends and after some explicit requests coming from some environmentally conscious customers, the company launched a co-creation initiative aiming at finding new “green version” of its core product line. Thanks to this initiative, the company moved from selling undyed zippers to products realized with a natural dying process that is not performed in house but from an external specialized supplier. The new supplier was chosen thanks to the suggestion of one of the client of the company that directed the company toward one of its supplier. The benefit is
twofold: clients are the one expressing the need on which the idea originated and they are the ones identifying suppliers matching their tastes and technical requirements, being already tested and proved to be trustful.

Cases 5 (gluten free pasta) and 6 (nuts biscuits). The company is one of the world's leader in food industry, grounded on Italian tradition. The offer is oriented toward nutritionally balanced products intended for daily use, produced mainly in Italy and exported to more than 100 countries. The NPD process is based on the interaction between different professionals both inside and outside the company, from nutrition experts to marketing managers. The development phase has a quite high level of complexity due to the identification of the right recipe while satisfying the technical requirements for the ingredients.

In 2013, the company decided to include in its offering the gluten free pasta (Case 5), due to the growing Italian population affected by the celiac disease (estimated in 1 percent of the whole population) and the increasing offering, by competing brands, of gluten free pasta, not only in pharmacies and specialized shops but also in supermarket (where the company is competing). The aim was not just to solve a medical problem but to offer a pasta that was satisfying the need of consumers and with close performance to the traditional one. Thus, the co-creation initiative had the aim to uncover the expectations and meet the taste requirement of both the celiac consumers and the not celiac ones, offering product with high quality that even individuals who do not suffer of this disease can eat with pleasure. In the first phase of the project, the company interviewed customers about their desires and expectations on gluten free pasta, explored their need by analyzing blog discussions and conducted focus groups. The interaction with the consumers provided insights about the texture, the taste and the color of the pasta. In a second phase, internal R&D run the product development on small scale (lab/pilot plant). More than one supplier, most of them already part of the long-term network were involved in this phase, to offer alternatives for the production of the gluten free pasta. Following, consumers were involved again in the tasting of some pasta prototypes and provision of feedbacks. The process was iterative, by coming back to the product development in small scale and by involving again suppliers when new ingredients were needed.

In 2012, the company developed a co-creation project on nuts biscuits (Case 6). Here the aim was to produce a new taste of biscuit to extend the existing range of offer. In the first stage, the company engaged its fans through the company Facebook page, by asking for new biscuits recipes. Customers were called to vote the biscuit recipe they prefer, among a pool of choices, but also had the possibility to propose new flavors. Once the preferred flavor was chosen by the consumers, R&D and marketing departments worked together to define the shape, the dimension, the texture and the color of the cookie. During the prototyping phase, suppliers were involved to provide support in the definition of the ingredients combination to achieve the desired taste. Finally, consumers were invited to taste the product and provide feedbacks.

Case 7 (fridge). The company is a multinational home appliances company. The company markets different brand and different types of home appliances (e.g.: dishwashers, washing machines, fridges). Recently, an innovative type of refrigerator has been launched with the main features being the touch screen display and a particular type of handle, which aim at positioning the product close to a design object rather than a functional type of item. The technical complexity of the refrigerator is high, given the criticality of parts and materials as the electronic boards and steel, making the involvement of specialized suppliers a keystone for the success of the project. The suppliers are indeed involved immediately after the conceptualization stage. The procurement function contact suppliers (minimum three); with them the company shares the design, performs feasibility technical analysis and analyzes the timing of the project. Based on these aspects, the company selects a single supplier and involves him for the detailed design of the fridge. A selected group of customers are then involved to test the product in real operative condition, providing structured feedbacks.
**Cases 8 (brick of tea) and 9 (frozen pizza).** The company is a multinational group leader in nutrition, health and wellness. The company has more than 2,000 brands worldwide and operates in more than 180 countries. Main businesses are: water, coffee, cereals, health products (including skin health), pet care and other professional offering. Case 8 refers to the tea brand of the company, whereas Case 9 refers to the brand offering bakery products. Overall, the company has a dynamic global network of R&D centers, focusing on both basic and applied research. The company has developed over time different types of technologies in a variety of fields from food processing technology to packaging and equipment.

As for the frozen pizza (Case 8), in 2013 the company decided to leverage on the success of one of its core product with a type of dough highly appreciated by customers to provide customers with new variants (i.e. new toppings).

The co-creation project included an initial screening of different concepts through information derived from social network channels through which the company collects insights in an unstructured way (i.e. without launching specific challenges). Chefs and suppliers are then involved to translate these insights into actual variants of toppings for frozen pizzas. Suppliers in this case are not limited to provide the raw materials on the basis of specifications provided by the purchases, but proposes and presents the company alternative raw materials that can improve the product quality. Suppliers are also involved whether a pitfall arises during the beginning of the industrialization stage. Finally, the newly developed toppings are tested by a selected group of customers.

Regarding Case 9, the specific project analyzed is the development of a new tea brick launched in 2014. The company needed a new idea, in order to differentiate its offer from competitors and face the decreasing profits in the tea brick business. The aim was to avoid price competition with private labels tea bricks, which did not have a peculiar brick shape. In the first phase, the company involved its supplier asking for ideas. Following, consumers were involved through focus groups with kids (4–12 years old), as they represent influencers in the purchase process, and mothers, as they are the final deciders. During focus groups, consumers were first stimulated in providing ideas without any link with the company. Then, they were asked to judge different tea pack options (both new packages proposed by the company suppliers and competitors’ packages). From the focus groups a new type of brick was chosen, the color was re-designed and the outer pack was changed.

**Case 10 (vacuum drawer).** The company is a global leader in household appliances and appliances for professional use, selling around 50 million products to customers in more than 150 markets every year. The company operates in two businesses: major home appliances like washing machines, refrigerators and ovens and small appliances, usually sold to other companies and for which customization plays an important role. It is leader in kitchen appliances including food preparation, storage and dishwashing and is the only manufacturer in the world to offer complete solutions for both consumers and professionals. The company uses a consumer-driven NPD in order to meet consumers’ need in shorter lead time. The NPD process sees the collaboration of marketing, R&D, design and external actors.

The co-creation project born around 2010 from the evolution in consumer lifestyle and the increasing demand for products that make life easier, make cooking healthier and food storage safer. The company uncovered the increasing need, among consumers, to cook food without losing nutritive characteristics, thanks to the observation of consumers during the cooking process. Seen the unanswered problem in the market, the firm decided to involve its chefs to find a solution: the idea was a vacuum drawer addressed to final consumers (the offer available at that time was addressed only to professionals). Hence, the company involved its chefs and organized courses with other chefs to understand how they use the vacuum drawer. Based on such results, a supplier (vacuum expert) was involved in the joint design of the product.
**Case 11** (*homogenized meat*). The company operates internationally in the food industry with a wide brand portfolio. Worldwide, the company operates in three main areas: sauces and ketchup, ready meals and snacks and baby foods. It has a significant presence in Italy since 1960, after the acquisition of a company operating in infant and medical nutrition. The NPD company objectives include developing new healthy products involving in-house professionals from nutritionists and food scientists to quality engineers and chefs. The company opened several quality innovation centers in a number of European countries.

The idea to launch a new type of homogenized meat came from the market analysis that underlines a trend among mothers who prefer for their children healthy food, hence with lower quantity of salt. In the first phase, in-house R&D developed the new recipe, analyzing the right balance of the ingredients. Following, direct clients’ analysis in the point of sales were organized. The company conducted two days trials of both the old and the new product in 200 supermarkets, to collect feedbacks and opinions about it. Suppliers were included only to change the label printed on the package.

**Case 12** (*vacuum cleaner*). The company is a leading manufacturer of wet and dry vacuum cleaners and carpet washers. It has an extensive presence in Italy and in more than 70 countries throughout the world. The leadership position has been confirmed along time thanks also to the introduction of radical innovations in the vacuum cleaner and carpet cleaning washer field. The extended product line is complemented by a series of accessories, providing solutions for a wide range of cleaning problems. The company produces the majority of component internally and personalization is a key success factor in the value offer to its customers.

The company developed a specific co-creation initiative for the development of a professional vacuum cleaner targeted to cleaning companies. The objective was to launch an incremental innovation in their dry vacuum cleaner line. The idea generation phase was entirely developed inside the company. Suppliers were contacted afterwards to provide some prototypes of the component required and to suggest ideas. Customers (cleaning companies) were involved before the launch and the commercialization to provide feedbacks. The company had also in loco contacts with its clients to understand how they use the machine and the problems they may get in touch with. The involvement process was iterative as suppliers were contacted again in case there was the need to modify the product according to customers’ feedbacks.

**Case 13** (*bottle of beer*). Case 13 is the European leader in the production of beer, which is exported to over 170 countries worldwide. The company has a very wide production network, made up by more than 130 plants worldwide. The company uses a structured innovation process, based on tried and tested best practices in order to complete the process effectively and efficiently. The project under investigation consists in a co-creation initiative launched in 2013, which allows anyone to propose a customization of a bottle of beer, modifying the basic sleeve by inserting a photo and/or a message. The final reward for customers is not only personal (drinking with friends from a personalized bottle of beer), but the company also decided to launch three selected sleeves at a large scale. Suppliers are involved to undertake feasibility analysis to figure out which part of the product can be modified by the consumer, limiting the impact on development time and cost. Suppliers are therefore involved in all phases of the development cycle. In the testing phase, suppliers carry out tests to evaluate the dimensional aspects and those aspects related to performance such as resistance, thickness and other physical characteristics of the product.

### 5.2 Answer to RQ1 and RQ2
To perform the case analysis and to display systematically (Miles and Huberman, 1994, p. 91) information about the involvement of actors in the NPD process, we divided the process in four main stages (e.g. Griffin, 1997; Pero et al., 2010; Krishnan and
Ulrich, 2001): needs analysis and idea generation, idea assessment, product design and development, test and product launch. Following, the definition of each stage is provided. Table II shows the results of this analysis:

(1) Needs analysis and idea generation: the company collects information from the customer to better understand the needs of the market. Further, it gathers ideas that will enable the generation of new products or the improvement of the existing offer.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Company</th>
<th>Co-creation initiative</th>
<th>Description</th>
<th>Co-creation mode with suppliers</th>
<th>Timing</th>
<th>Co-creation mode with customers</th>
<th>Timing</th>
<th>Actor owning more relevant knowledge and competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Needs analysis and idea generation</td>
<td>Case 2</td>
<td>Car scent</td>
<td>New variants of car scent (same shape but different style and color) in order to be close to a younger target</td>
<td>Adapts the design of products to “produrable” with not excessive cost.</td>
<td>(2) (3)</td>
<td>Customers are asked to draw their car scent design according to their own style and upload it on the website. Customers can also rate the design posted by other customers.</td>
<td>(1) (2)</td>
<td>Supplier—T</td>
</tr>
<tr>
<td></td>
<td>Case 9</td>
<td>Brick of tea</td>
<td>New solution for bricks of tea for kids with an innovative packaging in order to differentiate the offering from private labels</td>
<td>Two packaging options coming from proposals of two major suppliers</td>
<td>(1) (5)</td>
<td>Customers’ kids and their mothers are involved through a focus group and are asked to choose among a pre-defined list of packaging options. Customers also suggested a change in the color variants proposed.</td>
<td>(2)</td>
<td>Supplier—T–M</td>
</tr>
<tr>
<td></td>
<td>Case 13</td>
<td>Customized bottle of beer</td>
<td>Customization of specific parts of the bottle in order to provide customers a personalized offer</td>
<td>Suppliers heavily involved from the beginning of the NPD process, suggesting the idea of the initiative, performing ideas selection, feasibility assessment and testing of resistance, thickness and other physical characteristics of the product</td>
<td>(1) (2) (3) (4)</td>
<td>Customers involved for the detail design of the sleeve of the bottle through the website. They choose pre-defined sleeve and they can customize them further (e.g. inserting a picture).</td>
<td>(3)</td>
<td>Supplier—T</td>
</tr>
<tr>
<td></td>
<td>Case 3</td>
<td>Interbody cage</td>
<td>Evolution of a typical cage to treat degenerative disc diseases</td>
<td>Suppliers propose the material (steel, plastic, titanium) according to the company’s specific requirements</td>
<td>(3)</td>
<td>The trigger of the NPD process is an intuition of a surgeon (owner of the idea) put then in direct contact with the company’s engineers and suppliers.</td>
<td>(1) (2) (3) (4)</td>
<td>Customer—T and M</td>
</tr>
<tr>
<td></td>
<td>Case 4</td>
<td>Zipper</td>
<td>New “green product,” with organic cotton and recycled polyester to meet the expectations of more green customers</td>
<td>Zipper fabrics suppliers involved to change the pigments used to paint the fabrics. Choice of supplier of natural pigments. Fabrics supplier involved again during the testing of product performance</td>
<td>(1) (2) (3) (4)</td>
<td>Informal meeting with customers to collect ideas and trends. Final test of the product performance with customers</td>
<td>(1) (4)</td>
<td>Customer—M</td>
</tr>
<tr>
<td></td>
<td>Case 5</td>
<td>Gluten free pasta</td>
<td>Gluten free pasta to answer to the need of celiac people and meet the expectations of not celiac individuals</td>
<td>Suppliers offer to the company some alternatives concerning the recipe</td>
<td>(1) (2) (3) (4)</td>
<td>Initial focus group to collect feedback on customers’ expectations for: texture, taste and color. Customers are then involved in the testing</td>
<td>(1) (4)</td>
<td>Customer—M</td>
</tr>
<tr>
<td></td>
<td>Case 6</td>
<td>Nuts biscuits</td>
<td>New recipes for a new type of cookie, extension of the existing range</td>
<td>Chocolate suppliers are involved and decide to adopt milk chocolate rather than the usual dark chocolate</td>
<td>(1) (2) (3) (4)</td>
<td>Customers, represented by fans of the Company Facebook page are asked to rate the recipes proposed and to come out with new ones</td>
<td>(1) (4)</td>
<td>Supplier—T</td>
</tr>
<tr>
<td></td>
<td>Case 8</td>
<td>Frozen pizza</td>
<td>New variants of frozen pizza leveraging on the success of one of the key product for the company</td>
<td>Suppliers are involved to propose new toppings (e.g. special type of eggplant). Also involved at the beginning of the industrialization in case of some pitfalls</td>
<td>(1) (2) (3) (4)</td>
<td>Customers are involved in a first concept screening phase and then during the testing to taste the new variants of pizza. Distributors are instead involved to provide suggestions about the products chosen by the final customers during the customer tests</td>
<td>(1) (3)</td>
<td>Supplier—T</td>
</tr>
</tbody>
</table>

Table II. Case analysis: actors and timing of the NPD processes (continued)
Idea assessment: in this phase, actors involved in the NPD process can evaluate and select the best ideas among multiple alternatives. In this way, the company gives decision-making power to external stakeholders on the output of the NPD and therefore more control over the process.

Product design and development: decisions taken in this stage regard product specifications and the product’s basic configuration. A product concept generally envisions the physical form and appearance of the product. It includes the definition of technical specification, the determination of precedence relations in the assembly, the choice of the materials that will be used and the necessary production processes.

Test and product launch: it includes performance testing and validation. The product needs to be tested to validate the functions and evaluate if the product meets customer expectations. Further, decisions related to the market launch of the new product and to communication and promotion should be implemented.

Grounding on this classification, we explored the modes and timing of the co-creative process with customers and suppliers. Table II summarizes the main points of the analysis.

Notes: Approaches adopted to manage interaction flows among customers and suppliers
(1) = Needs analysis and idea generation, (2) = Ideas assessment, (3) = Product design and development, (4) = Test and product launch

Table II.

<table>
<thead>
<tr>
<th>Case</th>
<th>Description</th>
<th>Innovation</th>
<th>Co-Creation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leather bag and accessories</td>
<td>New product line: leather bags and accessories in order to develop a line extension</td>
<td>Suppliers involved for the technical drawings of the bag</td>
<td>Members of the Company club are involved to provide new ideas through the website</td>
</tr>
<tr>
<td>7</td>
<td>Fridge</td>
<td>Fridge with touch screen display and a particular type of handle to position the product close to a design object</td>
<td>Suppliers involved for technical advice during the detailed design of the product</td>
<td>Selected groups of customers involved in the testing phase</td>
</tr>
<tr>
<td>10</td>
<td>Vacuum drawer</td>
<td>New technology to cook in vacuum by removing 99% of the oxygen in order to provide customers with a professional technology not yet available on the final market</td>
<td>Best class supplier to adapt an existing technology in the professional business unit for the domestic market</td>
<td>Professional customers involved in order to give feedbacks about benefits and weaknesses of the product to be launched in the domestic business unit</td>
</tr>
<tr>
<td>11</td>
<td>Homogenized meat</td>
<td>An incremental change in the existing recipe of homogenized meat with no salt in order to meet customers’ needs of healthy food</td>
<td>Printing agency involvement for changing the label according to the new recipe</td>
<td>Customers involved in the point of sales to taste the product and to evaluate the differences with the traditional salted variant</td>
</tr>
<tr>
<td>12</td>
<td>Professional vacuum cleaner</td>
<td>An incremental change in a dry vacuum cleaner targeting cleaning companies</td>
<td>Components suppliers involved actively in the decisional process, proposing alternatives, giving to the company some prototypes based on the technical specification decided</td>
<td>Customers (cleaning companies) involved in the testing phase to help detecting and solving pitfalls when using the product</td>
</tr>
</tbody>
</table>

(2) Idea assessment: in this phase, actors involved in the NPD process can evaluate and select the best ideas among multiple alternatives. In this way, the company gives decision-making power to external stakeholders on the output of the NPD and therefore more control over the process.

(3) Product design and development: decisions taken in this stage regard product specifications and the product’s basic configuration. A product concept generally envisions the physical form and appearance of the product. It includes the definition of technical specification, the determination of precedence relations in the assembly, the choice of the materials that will be used and the necessary production processes.

(4) Test and product launch: it includes performance testing and validation. The product needs to be tested to validate the functions and evaluate if the product meets customer expectations. Further, decisions related to the market launch of the new product and to communication and promotion should be implemented.
(e.g. Cases 3, 5, 15 depicted in Figure 3) suppliers and customers are involved in the same phase of the NPD process. As reported in Table II, three are the main approaches emerged:

1. **Supplier-driven approach**, where suppliers are usually involved in multiple stages along the NPD process and especially in the early stages. The reason resides in the co-creation activity configuration that involves product features demanded at suppliers (development of the tea brick in Case 9, car scent in Case 2 and bottle sleeve in Case 13), in which they traditionally possess technical competences and knowledge but also knowledge of the final market, being themselves a competitor in the market (as in Case 9). For these products, the customer is included as well in the early stages only when she/he plays an “inventor role” (Cases 2 and 9 initiatives), while in cases approaching mass customization, the customers do not provide the initial product idea, and thus is engaged only in later stages (Case 13). In Case 9, for instance, suppliers are first involved in the proposition of an innovative packaging (a new brick of tea), customers are then asked to select the preferred package design and to propose changes according to their likings and needs. Finally, suppliers are involved again for the detailed design of the brick, including potential changes in the color and shape proposed by the customers.

2. **Customer-driven approach**, where customers are engaged in multiple stages of the NPD, developing broad joint co-creation processes. Here customers initiate the process, being involved in the early stages. In these cases, we can easily observe how the relevant knowledge is embedded in customers that propose ideas, suggestions and participate in the development and test of the product (In Cases 5 and 6 customers suggest recipes and rate them, in Case 4 customers suggest new ideas for the zippers). In these cases suppliers are involved in later stages, for the detailed design of the product (i.e. product design and development phase), introducing some technical constraints and therefore suggesting changes to translate not fully feasible proposals into implementable solutions. After changes are applied to the original ideas, products are tested again from customers in the last phase of the NPD process. A particular type of multi-stage involvement of customers is represented by Case 3, which shows a direct interaction between customers and suppliers with no needs of mediation by the company. This is indeed a case in which the knowledge embedded
in the customer is highly technical and really “stick” on the customer (a surgeon). She/he is the owner not only of the idea, but she/he has also the ability to translate it into technical requirements to be communicated to the suppliers. It should be noticed that here suppliers involved are mainly providing commodities, with very little
knowledge about the specific product and the final market. Their role is indeed marginal and limited to the sole product development phase.

(3) Firm-driven approach, in which customers and suppliers are involved in one sole stage of the NPD. In such approach, the company manages the conversation between suppliers and customers, not allowing direct information exchange and integration (Cases 1, 7, 10, 11, 12). For instance, in Case 7, the firm involves suppliers for the development of the refrigerator specifics, while customers only test the final product. No interaction or exchange of feedbacks, even with the firm mediation, is allowed between customers and supplier during the product development. We observe that for these initiatives, firms seem to possess the knowledge and competences to interact with the market. Thus, they engage stakeholders only in traditional activities, mostly product development for suppliers and market test for customers.

6. Discussion
This work aims to explore the mode and the timing of involvement of customers and suppliers along NPD projects, by developing a classification of demand-side and supply-side involvement in NPD; empirically investigating the interaction flows between customers and suppliers; analyzing the elements affecting a concurrent involvement of customers and suppliers in NPD. Results reveal that the integration of co-creation activities with the customer in the NPD process affects the way the firm itself co-creates with its suppliers, in terms of both information and communication flow. First, our findings suggest (RQ1) that firms work as mediators between customers and suppliers, managing the relationship with these partners in a separate fashion. This mediation operates for different reasons: in some cases represents a way to bridge a gap in competences or a physical geographic gap between suppliers and customers (Cases 5, 6, 7). In other circumstances, it is related to confidentiality of information (Case 10) or to the difficulties the company foresees in managing it (Cases 8, 11). On almost all cases analyzed, the mediation is needed due to the presence of organizational silos: marketing function, managing the co-creation with consumers, and purchasing/procurement department, managing the involvement of suppliers, do not communicate to each other. Main reasons behind this lack of communication and collaboration are the time and complexity required to integrate these functions, which are characterized by different competences and background. Hence, it is the company culture and internal organization itself that creates a barrier to the growth of a co-creation entity, a common foundation or platform for the development of joint co-creation activities. These organizational silos constraint the development of a direct relationship between the marketing and the buyer functions inside the company, and in its turn between customers and suppliers. Above hindering the development of a full collaboration between the two sides, these barriers may obstacle the anticipation of constraints, not enabling suppliers to intervene in the idea development to anticipate potential barriers in the prototype development or production. The misalignment of cultural values may emerge also between final customers and the firm itself, making even more difficult a proper communication and information exchange (Chan et al., 2010).

As depicted in Figure 3, firms tend to concentrate their effort on the development of co-creation activities on the customers' side, engaging them broadly in NPD process stages (i.e. in Cases 3 and 6). Suppliers, instead, show to be still lightly involved in such activities, particularly in the early stages and, when involved in later stages of the NPD process, they usually participate in the development of the idea proposed by customers (e.g. in Cases 5 and 6). Such result may be a consequence of the constraints and risks deriving from the knowledge exchange between firms and suppliers, as the ability to transfer knowledge and extract value from it (Cavusgil et al., 2003), but also the risk of knowledge spillover (Squire et al., 2008). Indeed, our findings show that supplier involvement takes place when suppliers
have long-term established relationships with the firm, thus there is trust that the information shared will not be used in opportunistic ways (Inkpen, 2000).

Overall, companies analyzed do not co-create with customers and suppliers in all NPD stages. Nevertheless, there are examples of companies involving customers and suppliers in the same NPD phase, even if not interacting directly (i.e. Cases 3 and 13) and therefore with an iterative involvement process inside a single NPD phase. Further, our findings show that the relationship between the two sides is moderated by suppliers and customers knowledge (RQ2), suggesting that the actors owning the relevant information and knowledge about the product and final market (Von Hippel, 1994) define the interchange between actors in the NPD.

7. Conclusions, implications and limitations
Co-creation is emerging as a desirable approach to product innovation. This study investigates the ways firms involve customers and suppliers in initiatives of co-creation along the NPD process. After developing a classification of demand-side and supply-side involvement in NPD we empirically investigated the typology of relationships between customers and suppliers in co-creation of the offer through 13 case studies, in both B2C and B2B markets. Further, we explored the factors potentially affecting a concurrent involvement of the two actors, namely, the typology of relevant knowledge and the way such knowledge is distributed among the actors. Results suggest that when co-creation with customers takes place, also the mode of suppliers’ involvement changes in terms of information and communication flows with the company. However, despite the intense dialogue and interaction between the company and customers and/or suppliers, companies tend not to let customers and suppliers communicate directly, but act as mediators between supply-side and customer-side contributions. Based on the cross-case analysis, three main approaches have been outlined: supplier-driven approach: companies co-creating with suppliers for multiple NPD phases, while involving customers only in one, customer-driven approach: companies co-creating with customers in multiple NPD phases, while involving suppliers only in one, and firm-driven approach: companies involving customer and suppliers only in one NPD phase. Remarkably, no companies analyzed co-create with customers and suppliers in all NPD stages.

Further, our findings suggest that the approach adopted is dependent on the locus of the relevant knowledge (i.e. market or technology), where the actor owning the relevant information and knowledge about the product and final market defines the interchange between actors in the NPD. When relevant knowledge is detained by the suppliers, the co-creation interaction is unbalanced toward the supply-side, meaning that suppliers are involved in multiple stages, usually in earlier ones, but customers only in one (supplier-driven approach). The opposite happens when the relevant knowledge resides in the customers. In such cases, customers are involved in multiple stages and suppliers in one phase only (customer-driven approach). When the firm itself possesses the relevant knowledge to interact with the market, no collaboration or exchange of feedbacks, even with the firm mediation, is allowed between consumers and suppliers during the product development (firm-driven approach).

This study opens a new stream of research, stressing how the evolution of the market, toward a more participative one, spurs the needs to investigate the collaboration and interaction approaches among the different actors. Customer and supplier involvement have been so far studied separately in literature. Despite the fact that the two actors have been listed as relevant members of a cross-functional inter-firms team for NPD (e.g. Boyle et al., 2005) and that their involvement in the NPD process has been studied separately (e.g. Koufteros et al., 2005), none has investigated in empirical terms the role customers and suppliers assume in cross-functional teams and their cross-interactions. We believe this study represents a relevant step to overcome this silos-centric view.
From a managerial point of view, we believe our results can help to efficiently and effectively design and manage the relation with suppliers (i.e. when and how to involve them) in co-creation along the NPD process. The same holds true for the demand-side, where marketing managers are provided with guidelines to understand which modes of customer involvement are most suitable, depending on the nature of the relationships in place or to be established with a supplier and the locus of relevant knowledge. Further, we suggest that more attention should be placed on the collaboration between marketing and buyer departments inside the company itself: one of the barrier toward a direct interaction between customers and suppliers seems, indeed, due to the presence of organizational silos where marketing function and buyer department do not communicate to each other. Hence, companies will need to incentivize a direct collaboration and information exchange between these departments, to improve the whole co-creation process (above potential other benefits of such integration). For instance, cross-functional teams or task forces dedicated to the management of co-creation projects can be a valid solution. Alternatively, unified virtual communication platforms or dedicated communication apps (such as Slack or Microsoft Lync), blending video, phone, instant messaging, task and project management tools, may prove successful in building collaboration between marketing and buyer departments. Additionally, barriers to knowledge exchange may occur, and prevent the development of co-creation initiatives, in the supplier-firm and firm-customers relations as well. From the demand-side, improving communication between firm employees and customers, through the share and reinforcement of common values, may help in the development of successful initiatives. From the supply-side, companies may establish the figure of relationship promoter, to enable the transfer of knowledge between the two sides and the share of value. Companies should try to establish long-term relationships with suppliers, based on trust, to lower the perceived risk of knowledge spillover. This can be done, for instance, by showing support to supplier needs or commitment through the implementation of supplier-specific adaptations.

Finally, the present work does contain some limitations that lie in part in the context adopted for the study. On the one hand, the cross-sectorial sample was ideal for our exploratory intent and helped us in finding evidences of different types of co-creation initiatives. On the other hand, there are contextual or product-related factors in different industries that can influence customer/suppliers involvement. Our focus on the patterns of interaction rather than the type of interaction allows us to limit the impact of contextual variables as for instance the complexity of the bill of materials of the product considered and the distance from the final market (i.e. B2B and B2C contexts). We therefore suggest as a further avenue for future researches, an industry and final market-specific study, explanatory in nature, to validate the findings we obtained from this exploratory phase.

Note
1. Knowledge are composed by two parts (Mokyr, 2002): propositional knowledge, theoretical and abstract, and prescriptive knowledge, which are techniques constituting the skill and competence companies can use to gain competitive advantage.

References


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Abstract
Purpose – The Australian retail food sector, comprising mostly small enterprises, is undergoing change as a result of the innovative supply chain approach adopted. This change has implications across the entire food value chain in Australia. The purpose of this paper is to empirically investigate the adoption of supply chain management practices on small and medium enterprises (SMEs) in the Australian food retail industry.

Design/methodology/approach – The study surveys 120 SME retailers in the food sector. A stepwise multiple regression using SPSS version 14.0 was performed on the data.

Findings – Statistical results suggest that lean thinking and the quality of information shared can lead to greater efficient supply chain performance.

Research limitations/implications – The small sample is the main limitation. The findings bear important implications for further research as understanding these dimensions can help to position key changes and industry improvement that will increase revenue and reduce cost to the SMEs in the food retail supply chain.

Practical implications – Adapting lean thinking and improving information sharing in the supply chain can reduce the cost for SMEs.

Social implications – This study has unique implications for social sustainability, especially the smaller food enterprises, which are hard pressed to combat the challenges within the food sector.

Originality/value – Innovative supply chain management helps SMEs to see beyond the silo mentality and helps them to focus on greater value addition in the supply chain.

Keywords Supply chain, Information quality, Lean

Introduction
The food retail sector in Australia is undergoing rapid change. This change is brought about by aggressive price competition (Round, 2006; Smith, 2006), food safety and quality concerns (Rong et al., 2011), private labels (IBISWorld, 2013), industry rationalization and integration of supply chain activities that affect small producers and processors (Van Donk et al., 2008), consumer demand for organic goods (IBISWorld, 2013), and innovation and research and development investment (IBISWorld, 2013).

These complexities arise due to globalization and the ultracompetitive marketplace, requiring faster speed to market. Consequently, the urgency of just-in-time production and lean thinking has led to lower stock levels. This then forces stricter quality assurance, which is built into the practice of supply chain management, to improve performance. Further, the change in the business environment points more outsourcing of food retail activities using rapid development of information and communication technology (ICT) tools. Technologies such as electronic data interchange (EDI), radio-frequency identification (RFID), self-checkout systems, smart phone application/payment and online shopping are increasingly adopted by the major retailers (IBISWorld, 2013). In such an environment, supply chain practices have been observed to impact supply chain performance (Trienekens et al., 2012; Van Donk et al., 2008; Wognum et al., 2011).

Australia has three large supermarket chains (Woolworths, Wesfarmers and ALDI) and many other smaller players, for example, Costco, IGA, Australian United Retailer and SPAR (IBISWorld, 2013). Woolworths is the largest chain, accounting for 39.1 percent of market share. Wesfarmers is the second largest player after its merger with the Coles Group (formerly known as Coles Myer) in 2007, accounting for 31.6 percent of market share. ALDI, holding only 4.8 percent, is reshaping the industry through aggressive price strategies,
home brands and offering other competitive but socially acceptable practices such as donating their excess produce to Foodbank OzHarvest and SecondBite (IBISWorld, 2013). To facilitate better inventory control, the quality and price of products, Australian food retailers have already implemented supply chain collaboration using contractual arrangements. However, the aggressive price wars between Woolworths and Wesfarmers and their hold on the contract farms are likely to have a negative impact on the small and medium enterprise (SME) food producers and retailers (Woodings, 2012). According to AC Nielsen, Woolworths and Wesfarmers control 80 percent of grocery sales, 50 percent of horticultural sales and 68 percent of meat sales in Australia (Woodings, 2012). The margins of the smaller and independent operators have thus suffered from the fierce competition.

In 2012–2013, the turnover of the Australian food industry (which includes food and beverage, grocery, and fresh produce) was $114bn, employing almost 300,000 people. This represents a third of all jobs in the manufacturing sector. Food retail forms the major chunk of this industry by value (80 percent). The Australian Food and Grocery Council estimates that the industry value added (i.e. total value of goods less the cost of production) for food and beverage manufacturing is $24bn. Indeed, the Australian food value chain generates $172bn per annum, with food SMEs forming 98.5 percent of all businesses.

Therefore, to increase the effectiveness and efficiency of supply chain management in the food sector, food retailers are actively exploring private brands as a logical extension of the supply chain integration concept moving further downstream. IBISWorld (2013) predicts three trends in the retail food industry. First, supermarket shelf wars are expected to intensify in the next five years. Second, the private label segment will continue to grow to account for 25 percent of all supermarket sales by 2020. Third, the sale of organic products will increase due to greater consumer demand for healthy products. Therefore, the literature combines knowledge of this swiftly changing environment to examine the supply chain practices of food retailers. In this type of business environment, supply chain management has been observed to have dramatic impact on the industry. Previous studies (Finch, 2006; Rong et al., 2011) have addressed the impact of supply, manufacturing/processes, transportation and demand uncertainty on supply chain performance in retail industries. However, there are few studies investigating how supply chain practices impact on food industry (e.g. Rong et al., 2011). Further, most studies were based on a small number of case studies, and research using quantitative methods such as survey questionnaires are rare (e.g. Aramyan et al., 2006). This study intends to fill the research gap and explore how such advanced supply chain systems have a potential to provide contributions to Australian food retail industry performance. Therefore, the research reported was focused on supply chain practices and supply chain performance efficiency in the Australian food retail industry.

In this research paper, the following research questions are posed:

**RQ1.** How do strategic supplier partnerships, customer relationships, information quality and information sharing, and a lean system affect the supply chain performance of the Australian food retail industry?

**RQ2.** How do trust and commitment in the trading partners affect supply chain practice and performance in the Australian food retail industry?

This paper reports on a study that evaluated the supply chain practices, which are important in influencing the supply chain performance of the Australian food retail industry. The rest of the paper is organized as follows. The second section discusses the supply chain performance indicators, supply chain practices, the antecedents of cooperative behavior and the Australian food supply chain structure. The third section provides the research method. The fourth and fifth sections present the results and discussion. The sixth section concludes with some limitations and future research directions.
Literature overview
Rapid industry rationalization and fierce cost reduction are shaping the Australian food retail supply chain. For starters, the vertical integration of the supply chain activities of large retailers such as Woolworths and Coles exerts pressure on the smaller food producers and processors. To reduce cost and improve efficiency, large retailers increase their private labels and exert coercive bargaining power to negotiate prices with the producers and processors (Round, 2006; Smith, 2006; Spencer and Kneebone, 2007). It is therefore necessary to measure and evaluate the complexity of the Australian food retail supply chain performance on the SMEs, given the influence from these larger players.

Previous studies confirmed that increasing collaboration with marketing process is very important to improve supply chain performance (satisfying customers and increasing efficiency) (Campo et al., 2000; Emmelheinz et al., 1991; Fitzsimons, 2000; Gruen and Corsten, 2007).

The evidence of research into supply chain performance indicators can be traced to 1980. Murphy et al. (1996) identified 19 such indicators; the most popular concerns the financial measurement such as the return on investment (ROI) and net income. These indicators can be summarized as efficiency and service effectiveness (Lai et al., 2002), flexibility and responsiveness (Cho et al., 2012; Lai et al., 2002) and quality (Persson and Ollager, 2002; Rong et al., 2011). Aramyan et al. (2006) have developed a conceptual framework for agrifood supply chain performance placing the performance indicators under the dimensions of efficiency, flexibility, responsiveness and food quality. Efficiency refers to how well resources are used (Lai et al., 2002) and is measured by profit, ROI, production and inventory costs. Flexibility, encompassing strategic and manufacturing flexibility, is an antecedent of agility (Ngai et al., 2011). Responsiveness seeks to provide shorter customer lead time (Persson and Ollager, 2002). Food quality, an essential indicator in the food industry, is directly related to the other food attributes of integrity, safety and shelf life (Rong et al., 2011). Given the long distance to Australia’s retail market and beyond, efficiency is chosen as an indicator in this study.

Several previous studies on strategic supply chain management (Barratt, 2004; Barratt and Oliveira, 2001; Bowersox and Closs, 2007; Burt and Doyle, 1994; Cammish and Keough, 1991; Clinton and Closs, 1997; Eloranta and Hameri, 1991; Freeman and Cavinato, 1990; Leenders and Blenkorn, 1988; Lowson, 2003; Lummus et al., 2001; McGinnis and Kohn, 1993; Morris and Calantone, 1991; Power et al., 2001; Reck and Long, 1988; Syson, 1989; Van Hoek et al., 2001).

Supply chain practice is taken as the independent variable for this study to show the set of intra or inter-organizational practices among the trading partners to improve their supply chain performance (see Figure 1). We now discuss each of the constructs.

Strategic alliances (SAs) are commonly viewed as long-term relationships between processors and producers, or processors and retailers (McNeil and Wilson, 1997; Spekman et al., 1998; Zylbersztajn and Filho, 2003). An SA highlights direct, long-term relationships and encourages reciprocal planning and problem solving efforts (Gunasekaran et al., 2001).
They appear to control the strategic, tactical and operational capabilities of participating organizations, thereby affording them ongoing mutual benefits. Previous study on retail strategy stated that the use of procedural justice and distributive justice to measure the fairness of trading relationships is useful and comprehensive way of categorizing the many different aspects of retail buyer behavior in trading relationships with suppliers (Duffy et al., 2003). Another previous study is to show why retail strategists need to develop long-term relationships capable of building business partnerships based on mutual trusts (Lee and Trim, 2006). The food sector is aware that organizations need to and can be more proficient through the management of scarce resources and superior management practices. For instance, SAs allow firms to share expertise or technical know-how to manage specialized business processes by outsourcing to partners by forming arm’s length relationships or even acquiring or merging with other firms (Braziotis and Tannock, 2011; Holweg and Pil, 2008).

Customer relationship management (CRM) is a key element in supply chain practice (Noble, 1997; Tan et al., 1998). CRM includes the gamut of practices employed to manage customer complaints, build long-term relationships with customers and improve client satisfaction (Noble, 1997; Tan et al., 1998). Committed relationships are a major sustainable advantage for competition (Day, 2000). With greater mass customization, CRM is imperative for survival (O’reilly and Paper, 2012; Wines, 1996). Previous studies on CRM included the main function of CRM is to closely interact with customers of a business to increase the level of service given to them (McGarry, 2006); creation of strong, long-term customer relationships is a form of competitive advantage as is creates barriers to competition (Day, 2000); close relationships among supply chain members including customers can lead to increase the value offered to the customer (Moberg et al., 2002).

Next, the element of information sharing is critical to a successful collaborative relationship and the nature of information flow between supply chain participants. This construct refers to the extent to which critical and proprietary information is communicated to a supply chain partner (Noble, 1997; Tan et al., 1998). A high degree of cooperative behavior would require that supply chain participants voluntarily share operating information and jointly plan strategies. Generally, information sharing has two aspects: quantity and quality. Both aspects are fundamental to supply chain practices and are independently constructed in prior studies on supply chain management (Choi and Hartley, 1996; Li and Lin, 2006). Information sharing can vary from strategic to tactical including operational planning and from information about logistics activities to general market and customer information (Mentzer et al., 2000). Research suggests that the key to a seamless supply chain is making available undistorted and up-to-date marketing data at every node in a supply chain (Balsmeier and Voisin, 1996; Childhouse and Towill, 2003; Towill, 1997; Turner, 1993). By taking data available and sharing it with other parties within the chain, information can become a source of competitive advantage (Barratt and Oke, 2007; Jones, 1998; Novack et al., 1995). Some studies on retail supply chains report that sharing information such as the point of sale data, forecasts, and inventory level increase supply chain visibility, thus improve organizational performance (Barratt and Oke, 2007; Lee et al., 1997; Yu et al., 2001). The sharing of information with enabled technologies such as internet- and web-based technologies have a positive impact on process management including procurement, manufacturing and distribution and enable supply chain partners to work collaboratively as an single extended entity to manage a supply chain (Gimenez and Lourenco, 2008; Wang and Lalwani, 2007).

On the quality of information shared, this includes aspects such as the accuracy, timelines, adequacy and credibility of information exchanged (Moberg et al., 2002; Monczka et al., 1998; Monczka et al., 1998). Divergent interests and opportunities of supply chain participants can affect the quality of information (Feldmann and Muller, 2003). The literature is replete with
examples of the functional effects of inaccurate/delayed information, as information moves along the supply chain (Lee et al., 1997; Mason-Jones and Towill, 1997; McAdam and McCormack, 2001; Metters, 1997). Li and Lin (2006) find that supplier uncertainty and inter-organizational relationships such as trust and commitment influence the level of information sharing and information quality. It has been suggested that organizations will deliberately distort information that can potentially reach not only their competitors, but also their suppliers and customers (Eckerd and Hill, 2012; Mason-Jones and Towill, 1997). There is a predisposition toward a perceived loss of power when giving away information, which, in turn, becomes a critical aspect of effective supply chain practice (Feldmann and Müller, 2003). Thus, organizations tend to view their information as a strategic asset and ensure that it flows with minimum delay and distortion (Barratt and Oke, 2007; Yu et al., 2001).

The principle of lean thinking refers to the “moving towards the elimination of all waste in order to develop an operation that is faster, more dependable, produces higher quality products and services and operates at low cost” (Slack et al., 2004, p. 519). Lean systems therefore focus on eliminating all kinds of waste (time and material) through the reduction of lead time and inventory levels, and to focus on systems that provide a total quality framework (Bell, 2006; Burgess, 1998; Finch, 2006; Srinivasan, 2004). Lean management includes the practices of JIT, total quality management, and work processes, total productive maintenance and supplier involvement (Amin and Karim, 2012). A number of studies, for example, find that lean thinking has become an important dimension in the food supply chain. Zarei et al. (2011) report that while the adoption of lean practices in the red meat industry in the UK is appropriate in the internal supply chain, it is difficult to apply to an inter-organizational perspective, as it might result in a high level of dependency on the buyers and decline the level of profitability.

Antecedents of cooperative behavior (trust and commitment)
The two components for improving the relationship among trading partners are trust and commitment (De Ruyter et al., 2001; Morgan and Hunt, 1994). Trust is the willingness to rely on an exchange partner in whom one has confidence and is the extent to which the buyer believes that a supplier has the necessary expertise to perform the activity effectively and reliably (Noble, 1997; Tan et al., 1998). Kenning (2007) suggests that trust has a positive relationship with buying behavior, for instance, repeated purchase and size of shipping basket. There are several dimensions of trust in the agribusiness supply chain, namely, confidence in a preferred trading partner, always keeping promises, always being honest, good reputation, belief in the information provided, close personal friendship, and a trading partner always considers our best interest. It usually takes time to develop trust and commitment in a strategic supplier relationship (Crotts et al., 2001; Hammervoll, 2011; Robson et al., 2008). Trust and commitment for food retail enterprises in Australia will improve relationships with future value to both parties (i.e. between producers and processors or between processors and retailers). For example, in order to sustain the relationship, the suppliers of food retail enterprises must deliver the right stock in the correct amount, at a price deemed reasonable to both parties. As a result, trust and commitment can improve supply chain performance through responsiveness, efficiency, quality and flexibility (Anderson and Weitz 1989; Mirani et al., 2001; Mohr and Spekman, 1994). It will allow the trading partners to maximize the efficiency of their capabilities and resources, and lower cost (Achim and Ritter, 2003). Clearly, collaboration cannot exist in supply chain relationships without meaningful commitment and trust. Trust is a general expectancy that the word of an individual or organization can be relied on (Rotter, 1967). Thus, trust is the willingness to rely on a trading partner in whom one has confidence (Ganesan, 1994; Mariotti, 1999; Monczka et al., 1998; Morgan and Hunt, 1994; Spekman et al., 1998). Overall, trust is the degree to which partners perceive each other as credible and
benevolent (Doney and Cannon, 1997; Ganesan, 1994; Kumar et al., 1995) and is expected to have a positive effect on the degree of collaboration in supply-chain relationships. In addition, trust is a key factor in fostering relational capabilities (Gilmore et al., 2006). Recent study on supply chain management and marketing process is considering trust as one of contingency variable in the SCM–M interface study at the firm level (Pero and Lamberti, 2013). Commitment is characterized by long-term relationships or the willingness of each partner to exert effort on behalf of the relationship. Commitment and trust are dimensions of a business relationship that determines the degree to which each party feels they can rely on the integrity of the promise offered by the other.

Supply chain practices are defined as the set of activities undertaken in an organization to promote effective management of its supply chain (Li et al., 2005). An extensive literature review above revealed that five aspects of the supply chain were likely to be particularly important to the Australian food retail industry: SA, customer relationships management, information sharing, quality of information sharing and lean thinking. These aspects generally exist on an intra or inter-organizational basis, for instance, between producers and processors or processors and retailers. Also, given that cooperative actions form the basis of the supply chain relationships, trust and commitment are necessary antecedents. Moreover, they would be expected to give various advantages to food retail industry including increased supply chain performance efficiency, and overall enable the industry to better satisfy customers. Improving these aspects of the supply chain would be expected to lead to higher profitability both by increasing revenues and reducing costs of firms in the supply chain.

Based on the extensive literature review above, we posit the following hypothesis (see Figure 2):

\[ H1. \quad \text{SA, CRM, information sharing, quality of information sharing, lean thinking, trust and commitment improve supply chain performance efficiency.} \]

**Method**

**Australian food supply chain structure (domestic)**

Webster (2001, p. 5) states the food and drinks supply chain: “the food and drink supply chain has been a linear relationship involving the primary producers, or farmers, the manufacturers or processors who fabricate the food for the table and the retailers who gather a range of such products and sell them to the consumer” (Webster, 2001)

There are four echelons or functions in food supply chain (producers, processors, wholesalers/distribution, food retailers and food services). Please see Figure 3 for Australian food supply chain structure.

**Producers**

The first function of Australian food supply chain structure is producers. In this regard, we use beef product for food supply chain structure. There are around 76,600 beef enterprises in Australia. Beef producer produces around 25m head of cattle in 2005 with gross value of
production around $5.7bn. Additionally, there is around 65 percent of production exported. The contribution of feedlot sector is around 27 percent of total beef production (ABS, 2005; Drum et al., 2007).

**Processors**
The second function of the Australian food supply chain is processors. In this regard, we are using beef product. Beef processors manufacture the cattle into carcase and primal beef and veal products. The most valuable product from beef processing is meat.

There are around 240 abattoirs in Australia. Abattoir is the factory where the cattle are manufactured into meat and other products such as offal and hides. Bone out is done primarily at the abattoir where the animal was killed. In order to have good quality and safety of the beef product as well as to ensure the humane treatment of cattle, abattoirs need to have a high level of government inspection and self-regulation.

**Wholesalers/distributors**
After processing beef or veal, those products may be distributed to the wholesaler or broker. Then they might go to the food services sector, butchers’ shops or supermarkets such as Coles, Woolworths, BILO, IGA, and Franklins. In this stage, the transportation is very important of delivering beef to either domestic or international markets. Beef is transported in refrigerated trucks with the surface temperature of one or quarters hanging carcase must not go above 7°C.

**Food retailers/food services**
Beef or veal products are distributed to food retailers (around 250,000 tonnes to go to supermarkets and around 71,000 tonnes to go to specialty) and food services (around 117,000 tonnes).

**Research design**
The research design involves a survey, and data collection and analysis. The data collection procedure includes sampling frame, sampling method, sample size, unit of analysis and key information techniques. A stratified random sampling (STRS) combined with purposive sampling method or judgment sampling was used in this study. STRS is a sampling method that divides the population into specific strata containing certain types of respondents, and then selects sub-samples of the required size drawn for each stratum. The pilot test was performed by inviting some industry experts to review the survey instrument. The final version was revised based on the comments from the panel of experts. A survey of the Australian food retail industry was conducted by distributing postal or online questionnaires to the retailers. The respondent profile and survey items are presented in Table I. We asked 800 participants to express their views on various aspects of supply chain management, with focus placed on the supply chain practices discussed above. The objective was to establish a model explaining the supply chain performance indicators of the retailers on supply chain practices. In other words, which

![Figure 3. Australian food supply chain structure](image-url)
### Table I.
Respondent profile and survey items

<table>
<thead>
<tr>
<th>Variable</th>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>SA1</td>
<td>Our firm treats quality as the number one criterion when selecting suppliers</td>
</tr>
<tr>
<td></td>
<td>SA2</td>
<td>Our firm regularly works together with our suppliers to solve problems</td>
</tr>
<tr>
<td></td>
<td>SA3</td>
<td>Our firm and key suppliers have a continuous improvement program</td>
</tr>
<tr>
<td></td>
<td>SA4</td>
<td>Our firm assists our suppliers to improve their product quality</td>
</tr>
<tr>
<td></td>
<td>SA5</td>
<td>Our key suppliers are involved in our planning and goal-setting activities</td>
</tr>
<tr>
<td>Alliance</td>
<td>CRM1</td>
<td>Our firm frequently measures and evaluates customer satisfaction</td>
</tr>
<tr>
<td></td>
<td>CRM2</td>
<td>Our firm frequently interacts with customers to set reliability, responsiveness and other standards for the firm</td>
</tr>
<tr>
<td>Customer</td>
<td>CRM3</td>
<td>Our firm frequently works to determine future customer expectations</td>
</tr>
<tr>
<td></td>
<td>CRM4</td>
<td>Our firm regularly evaluates the importance of our relationship with our customers</td>
</tr>
<tr>
<td>Relationships</td>
<td>CRM5</td>
<td>Our firm facilitates customers’ ability to seek assistance from us</td>
</tr>
<tr>
<td>Management</td>
<td>IS1</td>
<td>Our trading partners share business knowledge of core business processes with us</td>
</tr>
<tr>
<td>Information</td>
<td>IS2</td>
<td>Our trading partners share proprietary information with us</td>
</tr>
<tr>
<td></td>
<td>IS3</td>
<td>Our firm informs trading partners in advance of our changing needs</td>
</tr>
<tr>
<td>Sharing</td>
<td>IQ1</td>
<td>Information exchange between our trading partners and us is accurate</td>
</tr>
<tr>
<td></td>
<td>IQ2</td>
<td>Information exchange between our trading partners and us is timely</td>
</tr>
<tr>
<td></td>
<td>IQ3</td>
<td>Information exchange between our trading partners and us is complete</td>
</tr>
<tr>
<td></td>
<td>IQ4</td>
<td>Information exchange between our trading partners and us is reliable</td>
</tr>
<tr>
<td></td>
<td>IQ5</td>
<td>Information exchange between our trading partners and us is adequate</td>
</tr>
<tr>
<td>Lean</td>
<td>LT1</td>
<td>Our firm has a continuous quality improvement system</td>
</tr>
<tr>
<td></td>
<td>LT2</td>
<td>Our firm drives suppliers for shorter lead-times</td>
</tr>
<tr>
<td>Thinking</td>
<td>LT3</td>
<td>Our firm continuously streamlines ordering, receiving and other paperwork from suppliers</td>
</tr>
<tr>
<td>Trust</td>
<td>T1</td>
<td>Our trading partners respect the confidentiality of all the information they receive from us</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>Our trading partners have been open and honest in dealing with us</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>Our transactions with trading partners do not have to be closely supervised</td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>Our firms have invested a lot of effort in our relationship with trading partners</td>
</tr>
</tbody>
</table>

(continued)
aspects did those managers working in the supply chain consider essential to achieving supply chain performance. In all, 120 useable responses were received, giving an effective response rate of 15 percent.

We Armstrong and Overton (1977)'s suggestion to test for non-response bias. Non-respondent bias is possible in any data collecting procedure. The problem with non-response is the bias or systematic distortion in an exploratory study (questionnaire/survey) happening because of an incapability to get a response from some groups of the selected sample (Luning et al., 2002). Non-response may happen for any one of several reasons, such as not being in the firm at the time of data collection, refusal to participate in the research study, and so on. A typical method for assessing non-response bias might be to compare the kinds of respondents to the characteristics of the population from which the sample was drawn. However, this was not possible. Therefore, non-response bias in this study was assessed by comparing early to late respondents (Armstrong and Overton, 1977). They argued that later repliers are likely to be more representative of non-respondents than early repliers.

According to Table II, the $p$-value is 0.123, which is greater than $\alpha$ (0.05), so the null hypothesis would not be rejected. Hence, the non-response bias does not appear to be a concern in this research. For internal consistency, the results of Cronbach's $\alpha$ yielded values in the range of 0.60–0.87. As this study is exploratory, 0.50–0.60 is considered sufficient. Most items in the survey were based on previously established scales that passed content validity (Aramyan et al., 2006; Li et al., 2005). In addition, the pre-test confirmed that a group of industry experts viewed the scales used as acceptable. Discriminant and convergent validity was assessed satisfactorily. Factor analysis is a data reduction method used to decrease a large number of variables to a smaller set of underlying factors that summarize the important information contained in the variables (Coakes et al., 2005). More frequently, factor analysis is used as an exploratory method when the researcher wants to summarize the structure of a set of variables (in other words, to consolidate items which are correlated). However, for testing a theory about the structure of a particular domain, confirmatory factory analysis is appropriate to use

<table>
<thead>
<tr>
<th>Commitment</th>
<th>C2</th>
<th>Our trading partners have made sacrifices for us in the past</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C3</td>
<td>Our firm and trading partners always try to keep our promises to each other</td>
</tr>
<tr>
<td></td>
<td>C4</td>
<td>Our trading partners abide by agreements very well</td>
</tr>
<tr>
<td>Efficiency</td>
<td>SCPE1</td>
<td>Our firm has had a low inventory cost</td>
</tr>
<tr>
<td></td>
<td>SCPE2</td>
<td>Our firm has had high labor costs</td>
</tr>
<tr>
<td></td>
<td>SCPE3</td>
<td>Our firm has had low transportation costs</td>
</tr>
<tr>
<td></td>
<td>SCPE4</td>
<td>Our firm has had low operations costs</td>
</tr>
<tr>
<td></td>
<td>SCPE5</td>
<td>Our firm has had minimal waste cost</td>
</tr>
<tr>
<td></td>
<td>SCPE6</td>
<td>Our firm has made high profits</td>
</tr>
</tbody>
</table>

Note: Percentages do not add due to rounding errors; survey items (Li et al., 2005)

<table>
<thead>
<tr>
<th>Early</th>
<th>Late response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.924</td>
</tr>
<tr>
<td>Variance</td>
<td>0.147</td>
</tr>
<tr>
<td>$F$</td>
<td>0.728</td>
</tr>
<tr>
<td>$p$ ($F &lt; f$) one-tail</td>
<td>0.123</td>
</tr>
<tr>
<td>$F$-critical one-tail</td>
<td></td>
</tr>
</tbody>
</table>

Table I.

Table II. Non-response bias $F$-test two sample for variances between early and late response
The confirmatory factor analysis is normally used in the advanced stages of the research project. When the researcher's goal is to construct a reliable test, factor analysis is an additional means of determining whether items are tapping into the same construct. The factor menu in SPSS allows seven methods of factor extraction: principal components, unweighted least squares, generalized least square, maximum likelihood, principal axis factoring (PAF), alpha factoring and image factoring (Coakes et al., 2005). In order to assess discriminant validity, factor loadings are being used for each item. The loadings reflect the strength of the relationship between an item and a particular construct or factor. The higher the loading, the better the representation that particular item has on the factor. The factor loadings greater than 0.3 are the minimum requirement; loading of 0.4 are considered more important; and loadings of 0.5 or greater are considered significant. If the items have low factor loadings (lower than 0.3), they should be deleted.

Factorability of the correlation matrix – a correlation matrix that is appropriate for factor analysis will have several sizeable correlations. The procedure is to inspect the matrix for correlations in excess of 0.3 and, if none is found, reconsider the use of PAF. The anti-image correlation matrix is used to assess the sampling adequacy of each variable. Measures of sampling accuracy that falls below the acceptable level of 0.5 should be excluded from the analysis. Barlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy are both tests that can be used to determine the factorability of the matrix as a whole. If Bartlett's test of sphericity is large and significant and the KMO measure is greater than 0.6, then factorability can be assumed. (Table III)

Finally, stepwise multiple regression using SPSS ver 14.0 was performed on the model in Figure 1.

Results
Following our hypothesis that some relationship exists between supply chain performance efficiency and the explanatory variables of SA, information sharing, information quality, customer relationships, lean thinking, trust and commitment, our test results show that the regression run yielded an $R^2$ value of 0.58, and only quality of information sharing and lean thinking are significant influences on the food retailers’ supply chain efficiency.

Discussion
According to the results section (Table IV), two elements of supply chain practice (lean thinking and information quality) have statistically signification relationships with efficiency. Therefore, we will discuss lean thinking and information quality, respectively.

Lean system has the highest standardized coefficient, suggesting that the food retail sector should focus on lean thinking. Indeed, lean thinking is found to have a significant positive impact on efficiency in food retailers, where mismanaged information sharing can result in food wastage costs to all stakeholders. This is consistent with the lean thinking philosophy which is to drive out the unnecessary costs and other wastes from the entire supply chain. Hence, it can lead to greater efficiency of the business (Coote and Gould, 2006; McIvor, 2001; Taylor, 1999; Womack and Jones, 1996). According to MLA (2005, p. 12), “lean thinking could strip 30 percent of the costs from the supply chain.”

<table>
<thead>
<tr>
<th>Elements</th>
<th>Factor loading</th>
<th>Item deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply chain practice</td>
<td>Greater than 0.3</td>
<td>No items deleted</td>
</tr>
<tr>
<td>Antecedent cooperative of behavior</td>
<td>Greater than 0.3</td>
<td>No items deleted</td>
</tr>
<tr>
<td>Supply chain efficiency</td>
<td>Greater than 0.3</td>
<td>No items deleted</td>
</tr>
</tbody>
</table>

Table III: The summary of factor analysis output for Australian food retail
chain between the farm gate and the meat retailer. It needs a culture change in managing the business in a very large commitment, but over the next five years it’s the next major step we can make.”

Recently, two lean thinking concepts of takt-time (Simons and Zokaei, 2005), which is for horizontal continuous production flow, and standardized work (Simons and Zokaei, 2005), which reflects the need for continuous improvement have been suggested. Lean approaches have been ignored in the food industry according to Simons and Zokaei (2005) and Zarei et al. (2011). However, our research suggests that lean thinking has a significant positive relationship with efficiency, as lean practices can drive out the unnecessary costs and other wastes in the food supply chain. Drawing from the lean thinking approach (Amin and Karim, 2012; Hines and Taylor, 2000; Simons and Taylor, 2007), a firm should understand a customer’s specific requirements. It is necessary to establish a value stream by classifying products that follow similar paths from raw material to the point of consumption. Next, the bottlenecks of time-consuming work practices should be eliminated. Finally, supply chain pull strategies should be used to minimize inventory.

We propose a lean philosophy which resembles a Kaizen (plan-do-check-action (PDCA)) management model that involves a continuous improvement process for the smaller retailers and 5-S as a lean practice. Such Kaizen and 5-S programs, while common in the manufacturing and the automotive industries (Hirano, 1995), are scant in the food industry. There are good justifications for this case. First, these programs can improve operational efficiency by reducing waste. For example, the National Foods’ manufacturing plants in Morwell have applied lean practices (5-S, operator maintenance, production leveling, standardized work practices, and product and equipment rationalization) to improve the overall performance. As a result, operational efficiency improved by 55 percent, weekly production plan was achieved 95 percent of time, man hours reduced by 12 percent, lost time injury reduced by 53 percent, medically treated injuries reduced by 52 percent, reduction in sick leave by 5 percent and a reduction in physical waste by $20/ton of product (CSIRO, Victoria Government, AMPC, & MLA, 2007). Second, both Kaizen and 5-S are simple methods which are easy to apply by the SME food retailers and are more practical or tactical, rather than being strategic.

On the quality of information shared, our finding confirms the earlier studies (Li and Lin, 2006; Prajogo and Olhager, 2012). Better quality information shared ensures a better platform for supply chain partners to engage in supply chain coordination, participation and problem solving activities; this reduces the bullwhip effect. As suggested by Li and Lin (2006), the quality of information shared can be improved by sharing point of sale data, maintaining

---

<table>
<thead>
<tr>
<th>Regression statistics</th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Multiple $R$</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>$F$</th>
<th>Significance $F$</th>
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<tr>
<td>Regression</td>
<td>5</td>
<td>112.24</td>
<td>22.45</td>
<td>30.95</td>
<td>8.776E-20</td>
</tr>
<tr>
<td>Residual</td>
<td>114</td>
<td>82.68</td>
<td>0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>119</td>
<td>194.93</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>SE</th>
<th>$t$</th>
<th>$p$-value</th>
<th></th>
<th>Table IV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.791</td>
<td>0.387</td>
<td>2.046</td>
<td>0.043</td>
<td>Results</td>
</tr>
<tr>
<td>Lean</td>
<td>0.327</td>
<td>0.079</td>
<td>4.151</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Information quality</td>
<td>0.565</td>
<td>0.067</td>
<td>8.493</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>
consistent order cut-off times, and implementing advanced ICT. Prajogo and Olhager (2012) further argue that ICT capabilities and information sharing both have a significant impact on logistics integration. Food retailers have pressure to reduce the level of inventory. Thus, to facilitate better stock control, product quality and price, the Australian food retailers must adopt innovative supply chain practices to improve information sharing and quality of information sharing. For example, Woolworth adopted a web-based feedback system to share the information of meat quality. Coles built up meat processing facilities with Wire Cold Storage and advanced warehouse management systems to improve the quality of information shared between Coles and the processors.

Implications and conclusions
The results indicated that lean thinking and information quality have strongly positive impact on the efficiency key performance indicator; therefore, this research discussed lean thinking and information quality, respectively. This paper has proposed a lean approach based on Kaizen philosophy (PDCA) as a continuous improvement in food retailers and 5-S as one of the lean practices. The 5-S approach is basically focused on organization, neatness, cleanliness, standardization and discipline. Several alternative suggested configurations to food retailers in order to have accurate, timeliness of information quality in food value chains are to establish EDI and bar-coding system; to realize that information technology advocates with respect to e-commerce; and to apply better tools and standards for their information system.

This research makes several contributions. First, we have a framework to describe and present the Australian food retail supply chain and its supply chain practices. The supply chain practices, supply chain performance indicators and antecedents of cooperative behavior in the Australian food retail industry are complex and diverse. Therefore, understanding these dimensions can help to place key changes and industry improvement that will increase revenue and reduce cost to the SMEs in the food retail supply chain. The study has some limitations: the study used a questionnaire to examine the research questions. Future research will use multiple case studies to triangulate the supply chain practices and performance of food retail industry. Second, this study only used efficiency as the supply chain performance indicator. Other indicators such as flexibility, quality and responsiveness can be examined in future.

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Customer influence on supply chain management strategies

An exploratory investigation in the yacht industry

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Abstract

Purpose – Customers influence companies’ operational strategies and supply chain (SC) processes. In this vein, signals coming from the market must be translated into proper strategies in terms of production and supply. The purpose of this paper is to provide an understanding on how to transform customers’ expectations into SC decisions. The yacht industry, encompassing both technical and emotional peculiarities, becomes this study’s driven focus to interrogate the interrelationship between supply and demand.

Design/methodology/approach – The study explores the luxury yacht industry through exploratory case studies conducted with eight companies operating in Italy.

Findings – It was found that a wide range of factors influenced customers. That is to say, brand reputation, other brands’ involvement in the final product and emotional appeal were the most distinguishing characteristics identifying emotion-oriented customers. In this sense, companies serving such customers adjusted their SC strategies to channel a direct emotional impact. It was noticed that personalization was pivotal and companies were increasingly required to customize and create unique products to attract and further satisfy the customers. Thus, multiple sourcing strategies were often employed with an increasing number of suppliers to ensure that increasing material supply need would be met. As for performance-oriented companies, cost, quality and innovation capabilities emerged as key signals to be embedded in operations management. Companies serving performance-oriented customers were characterized by low product value and medium level of customization, and kept their core activities, including design and architecture, vertically integrated. In order to generate cost advantages without compromising product quality, single sourcing strategy was largely implemented. What the findings suggested is that the customization level and the product value were positively correlated. To illustrate, companies having more exclusive products were found allowing their customization and customer involvement in higher degrees.

Originality/value – Due to a relatively unexplored nature of the phenomenon, this study opted for a method by which individual and collective reconstructions were explored in a not well-investigated area, that is, the luxury yacht industry.

Keywords Case studies, Luxury industry, Supply chain management, Yacht industry, Marketing and supply chain management

Paper type Research paper

1. Introduction

During the 1990s, individual companies started becoming members of larger networks where independent units were transformed into integrated chains (Caniato et al., 2012; Vachon and Mao, 2008). Supply chain (SC) consists of upstream and downstream partners in the management boundary (Brandenburg et al., 2014). In this vein, SC encompasses a complex set of nodes that are intersected by information, cash flows and material flows (Persson, 2011). SC management (SCM) hence refers to the management of these intersected businesses to deliver products and series required by the end consumers (Harland, 1996). To this end, SCM could be described as the management of physical, logical and financial flows in networks of intra- and inter-organizational relations (Mentzer et al., 2001).

Earlier studies address distinctive SC models to show how companies could understand the nature of demand for their products and how they could accordingly organize their SCs that could meet the demand. To this end, Fisher (1997) articulates that there exist two types of
products, namely, functional and innovative for which two types of strategies could be applied. Either an efficient or a responsive SC strategy could be utilized depending on the product type. However, Lamming et al. (2000) advance what was hitherto addressed and suggest that product innovation, complexity and uniqueness emerge as important aspects that could impact the way a supply network should be managed.

Nevertheless, product-related characteristics must be combined with demand and lead times based indicators to better match market demands. Accordingly, Christopher and Towill (2002) develop a classification in accordance with market demand, product and supply lead times. Yet, lean and agile SCs cannot be considered only available strategies. Reliability is an important facet within SCM. Amongst performance metrics are customer satisfaction (Beamon, 1999), level of customer perceived value of product and customer complaints (Beamon, 1999) that indicate the extent to which customers influence companies’ operational strategies.

In this vein, Childerhouse et al. (2002) propose a model to ensure that demand chains are engineered to match customer requirements. Product characteristics could be used as instruments to provide a segmentation to enable such a focus. A classification could enable specific results generated in one industry to be placed in a broader context. However, configuring SCs through different positioning strategies by focusing only on product might not extend implications because product, brand and retail channel altogether appear to be driving SC configuration and management strategies (Brun and Castelli, 2008). On the whole, novel strategies must be sought to reorganize supply networks in order to advance the distribution toward larger consumer bases (Brun et al., 2017).

In today’s growingly complex and competitive business structure where customers are demanding for more and customized approaches are becoming increasingly dominant the interface between marketing and SCM appears to be more and more crucial. The definition of SCM, as the integration of supply and demand management, involves many practices common to the discipline and practice of marketing and marketing management (Pero and Lamberti, 2013). Customers affect operations management practices (Lee et al., 2015) and SC decision-making processes, which are not integrated into marketing decisions are expected to cost the company twice (Bell and Chen, 2017). Relatedly, the quality of the company’s strategic and tactical decisions is found being dependent on how the company makes marketing and SC decisions.

The significant benefits appear for those manufacturers who could successfully and strongly integrate production, logistics and marketing decision making (Bell and Chen, 2017). As earlier research shows, Gucci’s decline stopped through Tom Ford’s strategy in which his business model adoption maximized internal controls in terms of product sourcing, brand communication and distribution (Moore and Birtwistle, 2004). Furthermore, companies, skillfully managing the entire customer experience, benefit from customer satisfaction, increased employee satisfaction and increased revenue and they even find more applicable ways to collaborate across functions and levels (Rawson et al., 2013).

Yet, as Pero and Lamberti (2013) stress, in spite of such benefits, the nature and implications of the interrelationships of SCM and marketing have not been fully explored. Some negative consequences could still be drawn as a consequence of such inappropriate integrations. On the marketing side, for example, the lack of collaboration with the SC could lead to negative effects on the ability to embrace market- and consumer-oriented practices. On the SCM side, additionally, the lack of coordination between SCM and marketing could result in unsatisfying customer performance (Pero and Lamberti, 2013). Thus, gaining a deeper understanding on why and how marketing and SCM should be managed appears to be growingly imperative for both research and management.

This study attempts to analyze whether and to what extent a particular industry characterized by low selling volumes and high product complexity translates what customers expects into strategic SC decisions. The goal is to explore the extent to which...
companies operating in a specific context, that is, the yacht industry adjust their strategic SC decisions in accordance with their customer expectations. The remainder of the paper is organized as follows. First, theoretical background is provided in Section 2, which is followed by research methodology in Section 3. Findings are displayed in Section 4, leading to the study’s discussion in Section 5. Finally, conclusion and future research avenues are presented in Section 6.

2. Theoretical background

Luxury consists of very heterogeneous products and services, including personal goods, jewelry and highly complex systems such as jets and yachts. Luxury is distinctly separated from other traditional industrial sectors since a strong factor of human involvement, limited supply and the value recognition by others are some of the distinguishing features (Vigneron and Johnson, 2004). A luxury brand is considered the one whose ratio of functionality to price is low when the ratio of intangible and situational utility to price is high (Vigneron and Johnson, 2004). Legitimacy in luxury is essential, and therefore some factors whose significant consideration is pivotal to operate in luxury are highly critical.

Market characteristics emerge as a relevant set of contingent variables, which must be taken into account while evaluating the most appropriate SC strategy for a certain context (Caniato et al., 2009). However, not all contingent variables derived from SC models could be applied to companies operating in the luxury market (Caniato et al., 2011). To this end, there are some critical success factors (CSFs), including premium quality, heritage of craftsmanship, exclusivity, emotional appeal, global reputation, recognizable style and design, country of origin, uniqueness, technical performance and creation of a lifestyle, which must be encompassed in order to obtain competitive advantage in the luxury markets (Caniato et al., 2009).

Nevertheless, a luxury product does not necessarily have the entire list of CSFs. For example, quality and technical performance are more highlighted areas for sports cars. The legitimacy of luxury expects to be accomplished with the excellence in terms of experience. After all, luxury is a distinguished offering, delivering symbolic and experiential value alongside functionality (Grigorian and Espinoza-Petersen, 2014). True luxury brands should go beyond offering “luxury” at the product level. Design and communication management is only a part of the prerequisites contributing to the success of a luxury firm. Therefore, product line management, customer service management and channel management, in other words the entire SC, appear to be relevant to achieve success in the luxury industry (Brun et al., 2008; Caniato et al., 2009).

Luxury should not be abstracted as a set of characteristics (Sjostrom et al., 2016). There must be harmony between functional, experiential and symbolic magnitudes. Given that the concept of demand chain is the whole manufacturing and distribution process as a sequence of events to serve the ultimate customer (Childerhouse et al., 2002), the SC has to be oriented to customer satisfaction whose influence affect not only physical aspects but also the SC structure (Ponticelli et al., 2013). On the one hand, partner selection, decision-making, equipment integration and information processing are some of the critical factors to consider for the companies belonging to low degree of supply network dynamics and high degree of focal firm influence (Harland et al., 2001); on the other hand, an integration between planning and demand forecasting is essential for those whose ability to respond to demand information is hindered by longer lead times (De Treville et al., 2004).

Earlier research suggested that a perceived limited supply of products advances customer value and preference for the brand. Such observations seem to be consistent with other finding articulating the importance of uniqueness (Brun and Castelli, 2013). Accordingly, it could be suggested that the inherent scarcity as well as the exclusivity of prestige goods could satisfy the need for uniqueness (Vigneron and Johnson, 1999).
Additionally, it was found that companies that can skillfully manage the entire customer experience gain enormous rewards including customer satisfaction, increased employee satisfaction and increased revenue. They even discover more effective ways to collaborate across functions and levels (Rawson et al., 2013).

To excel in customer satisfaction and to provide peculiar luxury experiences, upstream and downstream parts of a luxury SC must be strategically coordinated. Yet, the supply network complexity requires a more structured supply management (Caniato et al., 2011). The choice of the SC configuration must also be coherent with CSFs (Brun et al., 2017). But luxury companies often have difficulties at the chain level. On the one hand, the integration of traditional marketing initiatives to logistics, production and relationship management (Ponticelli et al., 2013); on the other hand, the difficulties of making unique products and selling them at higher prices become more and more challenging for the luxury companies (Riot et al., 2013). Luxury companies seek competitive advantage over brand exclusivity (Robinson and Hsieh, 2016), however, the extant literature fails in providing a deeper understanding of how to design and implement unique luxury experiences (Grigorian and Espinoza-Petersen, 2014).

Product complexity and brand reputation require an articulated structure since such companies must encompass both soft factors, incorporating lifestyle, exclusivity, emotional appeal, and hard factors, involving style, design and performance. Conversely, complex products encompass many technology-intensive and interrelated components, and therefore a deeper upstream and downstream network association is largely required. As previously indicated, a strong commitment to brand repositioning is a prerequisite for market success, and yet again marketing efforts cannot guarantee long-term stability (Caniato et al., 2011).

To summarize, existing knowledge gaps involve lack of theoretical approaches and set of tools to show how companies can actually manage the interface between SCM and marketing. Albeit being critical, supplier and customer relationships management are not merged in theory and therefore both ends of the value chain must be jointly investigated to provide theoretical as well as managerial implications. To this end, benefits as well as particularities of such integration could be explored so as to optimize the company performance. Furthermore, contextual variables must be taken into account given industry-specific CSFs. Hence, research angle could take an interesting posture in terms of how to configure SCM choices whilst working on customer experience optimization in specific industries. Along that line, the questions can become even more interesting when unconventional industries in which product complexity is high and selling volumes are low are given a closer look; for example, the luxury yachts industry do not fit hitherto consolidated SC models due to its industry characteristics. On the whole, there is a research call to understand how the intersection between marketing and operations management can be better managed, and how managerial practices can be given contributions on how to execute complex projects to meet not only customer expectations but also operational goals.

The next section explains the research method by providing further details regarding research objectives and formulated research questions followed by identification of the sample and data execution.

3. Research methodology

3.1 Research objectives

A deeper understanding is needed to understand how marketing and SCM could be managed in terms of management because some inappropriate integrations could result in less favorable situations. For instance, the lack of coordination between SCM and marketing might cause result unsatisfied customer performance. In this vein, luxury’s emotional and psychological dimensions offer many rooms for exploration. There is ample evidence coming from process-based luxury segments such as personal luxury goods, nonetheless there is a
research scarcity in terms of complex luxury products. In this sense, yachts could be considered one of the most complex and luxurious products pertaining to both technical and emotional challenges. Further, yacht is believed to be the outcome of a mix between high-tech systems with the craftsmanship (Ponticelli et al., 2013). Yachts present an interesting yet an unexplored angle to interrogate the interrelationship between SCM and customer relations management. This study accordingly attempts to analyze whether and to what extent companies operating in the yacht industry adjust their strategic SC decisions pursuant to customer expectations and how customer relationship is translated into SC operations.

3.2 Research questions
In accordance with aforementioned objectives, the current study formulates two guiding research questions:

RQ1. Whether and to what extent do companies operating in the yacht industry adjust their strategic SC decisions pursuant to customer expectations?

RQ2. How is customer relationship management translated into SC practices?

In this vein, research variables are uncovered in Table I to demonstrate theoretical constructs that research questions investigate. This study opts for an exploratory method where individual and collective reconstructions were collected. To this end, case study methodology was pursued to seek, interpret and uncover the phenomenon.

3.3 Sample selection
A case study design was pursued in which purposive sampling approach was taken. Italy emerges as a peculiar country for the global yacht industry. In 2015, Italy was selected as the top builder in the luxury yacht industry, as what was produced in the country

<table>
<thead>
<tr>
<th>Research Variable</th>
<th>Definition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competencies</td>
<td>Companies’ ability to perform efficiently. The identified seven blocks are sensitive dimensions that are utilized to represent companies’ strongest competencies and that influence the customer experience</td>
<td>Pre-sales services, production and engineering, technology, design and architecture, interiors and exteriors, accessories, after sales services</td>
</tr>
<tr>
<td>SCM Drivers</td>
<td>Supply chain management</td>
<td>Quality, sustainability, time-service level, cost, brand reputation, external know-how, innovation capabilities, technology expertise, flexibility</td>
</tr>
<tr>
<td>Sourcing</td>
<td>A procurement process, which is part of the purchasing strategy. The number of suppliers and the type of the relationship to be formed with the suppliers are greatly important</td>
<td>Multiple sourcing, single sourcing, dual sourcing, parallel sourcing</td>
</tr>
<tr>
<td>Specification</td>
<td>The extent to which suppliers are involved in the product development phase depending on their collaborative configurations</td>
<td>Black box (supplier driven), gray box (joint specifications), white box (customer driven)</td>
</tr>
<tr>
<td>CRM Drivers</td>
<td>Customer relations management</td>
<td>Quality, sustainability, time, cost, yacht—producer brand reputation, other brand involvement in the projects, innovation, emotions</td>
</tr>
<tr>
<td>Customer involvement</td>
<td>The degree to which customers involve in the project development</td>
<td>Low, middle, high</td>
</tr>
</tbody>
</table>
accounted for 38 percent of the global production. As such, it was reported that 10,474 meters were actually produced in Italy while 27,365 meters were produced globally. In this vein, the Italian boating industry, employing 180,000 individuals, accounted for 2.5bn euros in 2014 (UCINA, 2016); further, the 93 percent of the national production are sold in foreign markets. Hence, this study was specifically conducted in Italy. This also ensured the case comparability, as potential contingency effects pertaining to cultural differences were eliminated. On the whole, case studies were conducted with eight Italian players operating in the luxury yacht industry. Table I accordingly displays the sample companies’ characteristics.

The product value represents a quantitative classification variable whose unit of measure is k€/meter. Literature classifies the yachts in high and ultra-luxury categories without defining a specific threshold. To this end, the sample companies were categorized depending on their value for one meter. Cases B, D and H are characterized by a value that is much lower than the ultra-luxury yachts. Additionally, the customization level emerges as a qualitative classification variable. That is, a degree to which the customer is involved in the design and project finalization processes. For example, low customization refers to a yacht chosen from a catalogue by the final customer without a radical personalization. Semi-customized yachts, on the other hand, refer to a product range having wider customization opportunities. Finally, full customization implies that the company does not provide a product catalogue; rather it offers bespoke solutions in which customers are fully integrated in product design and project development phases. To illustrate, it could be stated that the customer has the entire control over the process, and depending on his choices, the company configures and executes the entire production. It is important to note that these two dimensions, namely, the customization level and the product value, are positively correlated. In other terms, the products having a higher market value are found having a higher customization degree.

3.4 Data management
A structured analysis was performed to investigate the phenomenon. In 2016, a semi-structured interview protocol was developed and interviews were conducted with managers of abovementioned companies. Each interview lasted around 60 min while archival documents were additionally reviewed to triangulate the responses.

First, within-case analysis was conducted, which allowed the study to gain a broad understanding of the extent to which luxury yacht companies adjust their SC decisions pursuant to customer expectations. Subsequent to within-case analysis, cross-case analysis was employed to identify common patterns. Eventually, a coherent understanding was reached on how customer relationship management was translated into SC practices. Reliability was also obtained, as the case study protocol and internal case study database were arranged.

Topic guide including variables and research constructs utilized throughout the data execution process are displayed in Appendix 1 while cross-case results are exposed in Appendix 2 by mapping individual cases in accordance with research variables. Respectively, the findings are presented in the following section.

4. Results
4.1 Findings pertaining to RQ1
How do customer expectations drive strategic SC decisions? The luxury experience is different from simply offering the highest possible level of quality. The luxury experience expects to be designed and executed differently to provide symbolic value and emotional attachment. Hence, it is pivotal to differentiate emotional components from technical aspects
and it is imperative to translate signals coming from customers into SC practices. First and foremost, it is important to strategically analyze different customer typologies to better encapsulate how sample companies could execute their SCs accordingly. When sample companies were explicitly asked which factors were driving their customers, the results emerged in two main categories, namely, “technical” and “emotional.”

On the one hand, brand reputation, other brands’ involvement in the project, and emotional appeal were named as indispensable emotional factors triggering the final customers. In other terms, the final product gradually expects to be associated with symbolic value and emotional attachment. On the other hand, the technical drivers constituted rather performance-oriented facets, including cost, time, quality, innovation and flexibility all of which were related to the final product’s functionalities. Furthermore, amongst technical drivers, it was possible to observe two sub-groups: “efficiency orientation” and “innovation orientation.” Cost and time were highlighted as triggers of the customer desire toward efficiency; whereas, quality and innovation-related features were named as the customers’ search for peculiarity.

On the whole, there appeared to be three main target customer groups for which companies were required to revisit their managerial cognitions. Such target groups encompassed efficiency-oriented, innovation-oriented and emotion-oriented customers. With an attempt to translate qualitative information into a quantitative scale, the research team gave each driver a value. To illustrate, each company was evaluated in terms of its customers’ expectations and how significant such drivers for the operations management perspective. The interviews along with the secondary data were carefully examined to see which factors were driving companies to accordingly adjust their practices. The values constitute 1, 3, and 5 representing low, medium and high prioritization, while the values of 2 and 4 represent drivers affecting managerial actions from low to medium and/or from medium to high. Each driver was given a weight pursuant to how companies receive these signals from their customer bases. Table II depicts the target customer orientation per case in addition to an understanding of which factors are critical to be deployed for each SC.

Findings categorize customers based on their expectations, leading to suggestions for companies to further operationalize their actions to meet such anticipations. To this end, companies serving to efficiency-oriented customers, such as Company D in our sample, were found aligning their operations to satisfy customers by providing fair cost and shortened lead times. Companies serving innovation-oriented customer were observed focusing on their operations in order to advance the delivery of high quality products, provide more innovative solutions and offer more environmentally friendly solutions. Finally, companies providing emotion-oriented customers with products and/or services devoted their SC operations with a goal to deliver products that would valorize the prestige of their products for providing an emotional attachment and a feeling of empowerment. Table III displays an overall picture of how such drivers were translated into downstream orientation in each case (Table IV).

Yet, what must be highlighted is that these clusters were found strongly interlinked. Therefore companies were observed considering most of these aforementioned factors in their operations. Company B, for example, was chosen by customers those of driven by

<table>
<thead>
<tr>
<th>Case study</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>&gt; 200</td>
<td>&lt; 20</td>
<td>&gt; 250</td>
<td>&lt; 10</td>
<td>&gt; 250</td>
<td>&lt; 20</td>
<td>&lt; 20</td>
<td>&lt; 70</td>
</tr>
<tr>
<td>Product value (K€/m)</td>
<td>490</td>
<td>50</td>
<td>1,000</td>
<td>35</td>
<td>370</td>
<td>300</td>
<td>418</td>
<td>35</td>
</tr>
<tr>
<td>Luxury category</td>
<td>Ultra</td>
<td>High</td>
<td>Ultra</td>
<td>High</td>
<td>Ultra</td>
<td>Ultra</td>
<td>Ultra</td>
<td>High</td>
</tr>
<tr>
<td>Customization degree</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Outsourcing (%)</td>
<td>60–80</td>
<td>40–60</td>
<td>60–80</td>
<td>80–100</td>
<td>40–60</td>
<td>80–100</td>
<td>20–40</td>
<td>20–40</td>
</tr>
</tbody>
</table>

Table II. Sample companies
quality, innovative solutions and more environmental-friendly products. Thus, Company B was observed fostering innovation and co-design. Still, they worked on other components to align their SC objectives with other needs. Company A, on the other hand, had a customer base that is attaching more importance to emotional appeal and country of origin. So the company was found aligning its operational practices to deliver a more customized experience. Having this initial classification in mind, the very next section aims to further explore the specific translation of customer expectations into SCM.

### 4.2 Findings pertaining to RQ2

**How are customer expectations translated into SCM?** This section aims at bringing the discourse back to the mismatches between practical knowledge and theoretical contributions, and at revealing what findings have revealed. Earlier research stresses that cost has become a decisive parameter, as customers increasingly started perceiving yachts as long-term investments. In this sense, a number of different sourcing strategies named to be deployed to ensure premium quality and underline lifetime value. Relatedly, vertical integration can ensure companies to be in direct control of their value added activities. Case B revealed that their customers chose its products due to the company’s strong reputation, innovative solutions and perceived quality. Production engineering, interiors and exteriors and accessories-related activities were outsourced by using single sourcing through long-term partnerships in order to ensure the same level of cutting edge quality.

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Case</th>
<th>Performance area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotions</td>
<td>A, C, E, F, G</td>
<td>Brand reputation, other brands’ involvement, emotional appeal</td>
</tr>
<tr>
<td>Innovation</td>
<td>B, H</td>
<td>Quality, sustainability, innovation</td>
</tr>
<tr>
<td>Efficiency</td>
<td>D</td>
<td>Cost, time</td>
</tr>
</tbody>
</table>

### Table III. The classification of target customer groups

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Case</th>
<th>Performance area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotions</td>
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<td>Quality, sustainability, innovation</td>
</tr>
<tr>
<td>Efficiency</td>
<td>D</td>
<td>Cost, time</td>
</tr>
</tbody>
</table>

### Table IV. Sample companies’ performance orientation pursuant to customer expectations

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Case</th>
<th>Performance area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotions</td>
<td>A, C, E, F, G</td>
<td>Brand reputation, other brands’ involvement, emotional appeal</td>
</tr>
<tr>
<td>Innovation</td>
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<td>Quality, sustainability, innovation</td>
</tr>
<tr>
<td>Efficiency</td>
<td>D</td>
<td>Cost, time</td>
</tr>
</tbody>
</table>
Technology and interior and exterior design-related activities, on the other hand, were executed through a dual sourcing strategy between the buying firm and two suppliers. Information sharing along the chain has been growing as a key principle to meet customer demands and ensure the highest quality joint development strategies.

Design and pre-sales activities were mostly held in-house within the sample companies. Perceived quality and uniqueness were also observed getting dramatically affected by social and cultural values that might vary from customer to customer. That is to say, young customers were suggested being more driven by innovative product features. Hence, high degree of standardization emerges as an important feature to foster technical aspects, which inevitably results in low levels of customer involvement. Case D, accordingly, provided very precise and detailed indications to their suppliers to ensure homogeneity with respect to product specifications drawn by the customers. A specific strategy where suppliers and the buying firm jointly defined specifications was merely observed in interior and exterior design, including all goods concerning the yacht furnishing, marking information exchange as an open topic only with these suppliers.

As for the interior and exterior design, Case H provided the suppliers with precise information reflecting customer expectations. Interior and exterior design-related furniture and/or accessories were purchased from only one supplier through a single sourcing strategy. Co-design emerged as a profound practice for production, engineering and technology clusters where a dual strategy was deployed. Regarding design, any plan pertaining to production and engineering-related practices were jointly managed through a partnership between the buying firm and its suppliers, implying that gray box approach was pursued. Depicting and implementing a strategy on how to customize SCM according to customer demands plays a critical role. To this end, Case A gradually involved customers during design and development processes to increase overall satisfaction. Case A opted for taper integration with an attempt to create an optimal balance between in-house production and outsourcing.

Subsequently, collaboration with both upstream and downstream emerged as a key principle in the managerial cognition to ensure and improve customer experience through emotions. Case A, accordingly, pursued gray box approach where outsourced design was equally accompanied by in-house design capability, and therefore joint development and joint decision making were found characterizing the main foundation of upstream supplier management. In this vein, production-based activities were only outsourced through dual sourcing strategy while interior as well as exterior design-related activities, such as furnishing, were deployed through a wide range of suppliers.

Suppliers of Case A were categorized in two clusters. First, group of suppliers were related to production-, engineering- and technology-related processes, for which the company put cost, innovation capabilities, flexibility, know-how and quality as the main selection criteria. Second, group of suppliers, on the other hand, dealt with design, architecture, interiors as well as exteriors, all of which were associated with the brand image. Hence, supplier selection criteria for this category were driven by supplier’s reputation and time.

In order to provide a fulfilled customer experience, Case C customized many of its business activities by involving customers to the process, including the core steps of pre-sales services, design, development and production. This could be attributed to the fact that the company did not want to compromise the quality perceived by the customer. In this vein, Case E enlisted customers’ purchasing choices as brand reputation, other brands’ involvement in the projects, innovation and emotional appeal. Quality, surprisingly, did not appear as one of the primary criteria influencing customers’ purchase decisions. Case E correspondingly fostered its activities to enable customers to take a higher level of involvement in the development processes. Supplier relationship management was nurtured
through several communication tools and practices, and gray box specification strategy was observed rather dominant where co-design and development were performed jointly between the buying firm and its suppliers.

Additionally, the customers of Case F were found being highly involved in all stages throughout the entire process and the company aimed at developing services targeting further customer involvement. Particularly, after sales activities were paid a growing attention to generate a “serial buyers” effect. Interior and exteriors were paid a specific attention through both co-design and ingredient marketing with an attempt to optimize the customer experience. Thus, collaboration was fostered through co-design activities for production and engineering, co-branding for design and architecture and ingredient branding for accessories.

Within Case G, the customer involvement along the project development was observed getting higher in order to excel at customers relationship management. Despite reputation and emotional appeal being the decisive factors, quality and innovation became more and more important, respectively. It was suggested that the customers were growingly paying attention to interiors and exteriors, and after sales services. Therefore, interiors and exteriors along with the accessories were designed and executed through a more customer-centric approach. Furthermore, design specifications, production and engineering as well as technology was adopted within gray box specification characteristics where decisions were made jointly between the suppliers and the company itself.

In order to reach competitive advantage and to provide an exquisite customer experience, eight companies under investigation adjusted some of their strategic SC decisions according to signals coming from their customers. Figure 1 depicts a matrix in which companies were positioned according to their product customization level and target customers’ prioritized values. All in all, what customers have been seeking became a pivotal question for sample companies. Emotional appeal, other brands’ involvement and brand reputation evidently fostered companies to increase their customization level and therefore to orient themselves toward emotion-oriented customers; whereas, performance-oriented companies guided and driven by cost, time and quality indicators showed a more moderate trend toward product customization.
5. Theoretical discussion
Luxury is meant to last, empower and make individuals feel exquisite. As earlier findings highlight, the luxury experience is expected to go beyond basic product and/or service offering. Creating emotional attachment and value experience has become one of the main goals of luxury companies. Despite being already challenging to reach a balance between technical and emotional aspects, this becomes even more complex for certain industries, such as yacht, where high-tech systems are meant to meet craftsmanship. This section aims to seek an understanding on how complex supply networks could translate customer expectations into performance and how to create a more structured supply management to stipulate both quality and emotional appeal.

Findings support what was hitherto developed in the managerial literature and suggest that a wide range of factors, including emotional and technical aspects, influence the end-customers. As such, brand reputation, other brands’ involvement and emotional appeal become the most distinguishing characteristics of emotion-oriented customers, as targeted by Cases A, C, E, F and G. In this vein, companies serving emotion-oriented customers adjusted some of their SC strategies. In order to create a direct emotional impact on the customers, companies defined design, and production and engineering processes as their core activities and attempted to create unique designs.

Pre-sales services were mostly vertically integrated and internal resources were devoted to better understand the final customers with an overarching goal of establishing an emotional connection. Further, it was noticed that personalization was pivotal and companies were increasingly required to customize and create unique products to attract and further satisfy their customers. However, companies were often in need of high numbers of materials, even a large number of very same goods in some cases. To this end, multiple sourcing strategies were often employed with an increasing number of suppliers to ensure the need for increasing material supply to be met.

Additionally, customers’ perceptions were observed being improved through companies’ co-branding strategies. To this end, many of aforementioned companies relied on prestigious brands (including Armani and Fendi) to collaborate with other brands and to utilize ingredient branding for mostly furniture and design-related architecture features. What is suggested is that information sharing was crucial for these companies. Since customer involvement is required to be having a high degree, trust and relational capabilities among suppliers were vital not only to transmit customer expectations to further upstream suppliers but also to ensure product quality while tailoring the emotional appeal for customers. Emotion-oriented companies were defined by the highest product value and therefore it is clear that high degree of customer involvement and maximum product customization emerged as the most critical features to be maintained.

As for performance-oriented companies, cost, quality and innovation capabilities emerged as key signals to be embedded in operations management. Cases B, D and H, characterized by low product value and medium level of customization, kept their core activities including design and architecture vertically integrated. In order to generate cost advantages without compromising product quality, single sourcing strategy was largely implemented. Since standardization was deployed to a great extent, the same and yet a limited number of suppliers were found being utilized. To this end, SC structure shall be suggested to become less complex compared to other cluster.

6. Conclusion and future steps
The current study aimed at understanding to what extent companies operating in the yacht industry adjusted their strategic SC decisions pursuant to their customers’ expectations. Results were generated throughout multiple case studies conducted with eight companies operating in luxury yacht industry in Italy. Exploratory case study methodology was
pursued to seek meanings, interpret and uncover the creation of social reality through open
dialogue and negotiation with participants.

It was unveiled that luxury companies operating in the yacht industry must amend their
strategy by moving toward market orientation and innovation. Uninterruptedly, supply
networks must be coordinated to provide the best product quality while delivering
intangible values. What was explored suggest that the customization level and the product
value are positively correlated. Hence, more customization and, accordingly, a higher degree
of customer involvement are required.

In other terms, companies having more exclusive products were found allowing their
customization and customer involvement in higher degrees. It is suggested that the
companies serving to consumers-seeking efficiency and technical facets need to advance
performance related aspects. To this end, utilizing very same suppliers could ease
standardization and shorten lead times. Companies targeted by emotion-oriented customers,
on the other hand, must deliver an emotional attachment and uniqueness. Celebrity designer
collaborations and high level of customization must be ensured in a way in which their SC
structure could respond such demands.

6.1 Managerial implications
This study provides an original contribution. To the best of our knowledge, there are not
many studies representing complex industries where there exists a crucial intersection
between technical and emotional aspects. Hence, this study delivers a focal as well as a novel
point on which managers could see how certain characteristics of their operational
strategies could be revisited to be amended according to their customer’s orientation.
The luxury yacht industry was found being affected by a number of factors. That is, brand
reputation, other brands’ involvement in the final product and emotional appeal were the
most distinguishing characteristics that identify emotion-oriented customers. Therefore,
companies whose client bases are more emotional are suggested to adjust their practices to
further emphasize emotional appeal. Personalization, in this vein, is suggested as a pivotal
angle; therefore, managers must coordinate their suppliers to constantly customize and
create unique products to attract and further satisfy the customers. As for the customers
seeking rather performance related results, quality and innovation must be constantly met
and satisfied. Consequently, low to medium level of customization could be adopted; while
core activities, including design and architecture, could be vertically integrated. In order to
generate cost advantages without compromising product quality, single sourcing strategy
could be implemented. Finally, customization level and product value are found being
positively correlated. To this end, companies having more exclusive products must adjust
their operational strategies to further involve their customers’ involvement degree and
improve personalization approaches.

6.2 Future research directions
While providing an overall understanding and vital suggestions on how to embark on
emotional and technical aspects simultaneously, the current study invites scholars to further
investigate the phenomenon. This section aims at providing what future research could
explore. To start with, the study could be introduced to other contexts within different
industrial settings. Hence, future research could explore how the existence of some
contingent variables could affect the translation of customer requirements throughout SCM.
That is to say, a different country and/or cross-country analysis could be chosen. Changes in
the product typology could be another interesting angle to consider. As such, other complex
luxury products could be investigated to understand how high-end luxury consumers deem
certain things, for example, in terms of luxury cars or jewelry, and how SC practices are
arranged accordingly. Finally, about the methodological stance, it can be seen that findings
are not generalizable, as what this study channels have been generated based on observations and interpretations. Such observations could be utilized as initial steps for theory building, nonetheless it shall not be considered the final product. Therefore, survey methodology could be introduced to reach a wider audience and to provide evaluations by going through various stages of validation to reach statistical saturation.

References


Corresponding author
Hakan Karaosman can be contacted at: hakan.karaosman@polimi.it

Appendix 1. Topic guide
(1) Company information:
   • Company name.
   • Interviewee name.
   • Role in the company.
   • Percentage of the outsourcing (X) on final product’s cost.
(2) Company competences:

- Which of the seven blocks mainly represent your main competence for the company?
  - Pre-sale.
  - Production and engineering.
  - Technology.
  - Design and architecture.
  - Interiors and exteriors.
  - Accessories.
  - After sales.

- How do you manage these aforementioned blocks?
  - Which activities are completely managed internally?
  - Which key activities are managed internally?
  - Which activities are only partially managed internally?

- Which of the seven blocks are mainly characterized by high asset specificity (degree of company’s asset customization) and risk of opportunism (spill-over risk from supplier).

(3) Supplier relationship management: Taking into account only the blocks where activities are outsourced:

- Which ones are important for supplier selection?
  - Quality.
  - Sustainability.
  - Time-service level.
  - Cost.
  - Brand reputation.
  - External know-how.
  - Innovation capabilities.
  - Technology expertise.
  - Flexibility.

- Which is the sourcing strategy (for the categories identified as the blocks)? How has this strategy been changing by time?
  - Single sourcing.
  - Dual sourcing.
  - Multiple sourcing.

- Which is the collaboration approach? How has this strategy been changing by time?
  - Co-design.
  - Co-branding.
  - Ingredient marketing.
  - Licensing.

- Which is the specification and integration strategy? How has this strategy been changing by time?
  - Black box (supplier driven).
  - Gray box (joint development).
- White box (customer driven).

- Which is the visibility degree within the relationship in terms of information sharing? How has this strategy been changing by time?
  - Low.
  - Medium.
  - High.

- Which are the tools that the company uses to support supplier relationship management? How has this strategy been changing by time?
  - Team working.
  - Colocation (inter-organizational teams).
  - IT systems.
  - Web platforms.
  - Regular meetings.

(4) Customer relationship management:

- According to your experience and your target clients, which ones are of importance for your customers? How has this strategy been changing by time?
  - Quality.
  - Sustainability.
  - Time.
  - Cost.
  - Yacht—producer brand reputation.
  - Other brand involvement in the projects.
  - Innovation.
  - Emotions.

- Which is the degree of customer involvement during the project development? How has this strategy been changing by time?
  - Low.
  - Medium.
  - High.

- Once customer drivers and the involvement degree are identified, are you able to manage customer’s request along the entire supply chain? How has this strategy been changing by time?
<table>
<thead>
<tr>
<th>% Outsourcing</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
<th>Case D</th>
<th>Case E</th>
<th>Case F</th>
<th>Case G</th>
<th>Case H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core activities</td>
<td>Production and engineering, design and architecture</td>
<td>Pre-sales services, production and engineering, design and architecture</td>
<td>Pre-sales services, production and engineering, design and architecture</td>
<td>Pre-sales services, design and architecture</td>
<td>Production and engineering, technology, design and architecture, interiors and exteriors, after-sale service</td>
<td>Pre-sale service, production and engineering, design and architecture, after-sale service</td>
<td>Pre-sale services, after-sale services</td>
<td>Design and architecture, technology, after-sale services</td>
</tr>
<tr>
<td>Vertical integration</td>
<td>Pre-sales</td>
<td>Production and engineering, design and architecture</td>
<td>Pre-sales, production and engineering, design and architecture</td>
<td>Design and architecture</td>
<td>Production and engineering, technology, pre-sale service, after-sale service</td>
<td>Pre-sale services, after-sale services</td>
<td>Pre-sale services, after-sale services</td>
<td></td>
</tr>
<tr>
<td>Asset specificity</td>
<td>Production and engineering</td>
<td>Pre-sales, production and engineering</td>
<td>Design and architecture</td>
<td>Production and engineering, technology, design and architecture, after-sale service</td>
<td>Production and architecture, technology, after-sale service</td>
<td>Production and engineering</td>
<td>Production and engineering, technology</td>
<td></td>
</tr>
<tr>
<td>Drivers for supplier selection</td>
<td>Cost, flexibility, quality, time, brand reputation</td>
<td>Quality, flexibility, brand reputation, cost, sustainability, innovation</td>
<td>Flexibility, time, brand reputation, cost, quality</td>
<td>Quality, time, cost, external know-how, technology expertise</td>
<td>Quality, cost, brand reputation, innovation</td>
<td>Cost, quality, innovation capabilities, technology expertise</td>
<td>Time, innovation, technology expertise, flexibility</td>
<td>Quality, time, technology expertise, brand reputation, innovation</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>% Outsourcing</th>
<th>Case A 60–80</th>
<th>Case B 40–60</th>
<th>Case C 60–80</th>
<th>Case D 80–100</th>
<th>Case E 40–60</th>
<th>Case F 80–100</th>
<th>Case G 20–40</th>
<th>Case H 20–40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sourcing strategy</td>
<td>Multiple sourcing</td>
<td>Single sourcing (pre-sale service); multiple (after-sale service); dual (technology, interiors and exteriors, accessories)</td>
<td>Dual sourcing</td>
<td>Single sourcing (production and engineering, interiors and exteriors, accessories); dual sourcing (technology); multiple sourcing (after-sale service)</td>
<td>Dual sourcing</td>
<td>Single sourcing (production and engineering, design and architecture); multiple sourcing for the others</td>
<td>Dual sourcing (production and engineering, technology); multiple sourcing (interiors and exteriors, accessories)</td>
<td>Single sourcing</td>
</tr>
<tr>
<td>Collaboration with suppliers</td>
<td>Ingredient branding (interiors and exteriors, accessories); co-branding (design and architecture); co-design (production and engineering, design and architecture)</td>
<td>Ingredient branding (technology, accessories), co-branding (interiors and exteriors in future), licensing (after-sale in future), co-design (production and engineering)</td>
<td>Co-design (production and engineering, design and architecture, technology), co-branding (design and architecture); ingredient branding (interiors and exteriors, accessories); licensing (after-sale service)</td>
<td>Co-branding and ingredient branding (design and architecture, interiors and exteriors, accessories) co-design (design and architecture) (increasing importance in the future)</td>
<td>Co-design (interiors and exteriors, design and architecture, production and engineering); ingredient branding (accessories, interiors and exteriors); co-branding (design and architecture)</td>
<td>Production and engineering: co-design; technology and design and architecture: co-design; interiors and exteriors and design and architecture: co-branding, ingredient branding (+ co-design and licensing in future);</td>
<td></td>
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</tr>
</tbody>
</table>

*Table AI.*

(continued)
<table>
<thead>
<tr>
<th>% Outsourcing</th>
<th>Case A 60–80</th>
<th>Case B 40–60</th>
<th>Case C 60–80</th>
<th>Case D 80–100</th>
<th>Case E 40–60</th>
<th>Case F 80–100</th>
<th>Case G 20–40</th>
<th>Case H 20–40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification strategy</td>
<td>White box</td>
<td>Gray box</td>
<td>Black box (technology, design and architecture, accessories); gray box (production and engineering); gray/white box (interiors and exteriors, after-sale service)</td>
<td>Gray box (interiors and exteriors); white box (production and engineering, technology, accessories, after-sale service)</td>
<td>Gray/white box</td>
<td>Black box (accessories); gray box (production and engineering, design and architecture, interiors and exteriors); black box (technology)</td>
<td>Gray/white box</td>
<td>Gray box</td>
</tr>
<tr>
<td>Information sharing</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Customer drivers</td>
<td>Brand reputation, emotional appeal, other brands’ involvement</td>
<td>Quality, emotional appeal, brand reputation, time, innovation</td>
<td>Brand reputation, emotional appeal, other brands’ involvement, sustainability</td>
<td>Quality, time, cost, brand reputation, emotional appeal</td>
<td>Brand reputation, other brands’ involvement, innovation, emotional appeal</td>
<td>Cost, innovation, emotions, other brands’ involvement</td>
<td>Quality, sustainability, time, cost</td>
<td>Quality, time, brand reputation, innovation</td>
</tr>
<tr>
<td>Customer involvement</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
</tbody>
</table>
Leveraging customer knowledge to enhance process innovation

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Abstract

Purpose – Nowadays, companies compete and win based on the capabilities they can leverage across their supply chains. With unpredictable and turbulent business environment, supply chains are seeking to customer knowledge as sources of competitive advantage. The purpose of this paper is to empirically test a conceptual framework to investigate the roles of customer leverage (CL) on process innovation and the relationships to performance.

Design/methodology/approach – Drawing upon the knowledge-based view, this study argues that CL is the sources of firms’ process innovation. This study also posit that process innovation mediates the relationship between CL and performance based on transaction cost economics. This empirical study employed 650 manufacturers across different regions.

Findings – This study showed that strong association exists between a manufacturing firm’s CL capability and its process innovation and performances. Process innovation play critical mediating roles in absorbing and transforming customer knowledge in supply chains. In a more dynamic market, CL strengthens the positive impacts on process innovation.

Research limitations/implications – This study further highlights the need to emphasize both strategic and CL capability in dynamic environments as these may be needed to enable the firm to seize market niches that may open up in such environments. Similarly, managers should emphasize CL capability and process changes in competitive environments as they are more difficult to imitate from competitors in regards of new product or services.

Practical implications – These results extend the limited existing research on global manufacturing context that the customer knowledge are effective sources for increasing innovative processes. The higher the market turbulence, the stronger the pressures for CL demanded by process innovation. The findings also confirm that process innovation plays a mediating role in absorbing and transforming customer knowledge in improving costs and financial measures. This is an important result that highlights the mechanism by which customer knowledge can influence a firm’s bottom line.

Originality/value – This study examined the linkages between a marketing concept and operations and supply chain management.

Keywords Innovation, Customer knowledge, Knowledge management, Customer leverage

Paper type Research paper

1. Introduction

In the current business environment, intense competition, shortened product life cycles and rapidly changing customer needs have contributed to the need for more innovative and responsive supply chains. As a consequence, manufacturing companies are increasingly relying on better sources of knowledge that enhances their operational performances and consequently sustains their competitiveness (Al-Sa’di et al., 2017; Wang et al., 2015). Customer leverage (CL) reflects a firm’s capability in obtaining and usage of their obtained knowledge.
knowledge from customers in developing new products and services (Thakur and Workman, 2016). Many firms aim to benefit from the knowledge, skills and resources of their customers by jointly creating new products (Lau et al., 2010; Thakur and Workman, 2016), improving their supply chain processes for better costs and financial outcomes. Based on the social capital created between customers and manufacturers (Tsai et al., 2013), an understanding of customer experiences, perception, demand, expectations and preferences (namely, customer knowledge) can be effectively leveraged by the innovation developers such as R&D teams or work groups eventually enhancing the teams’ innovation performance (Rosell et al., 2014). Recent literature re-emphasized the importance of process innovation, especially in combination with internal and external sources to yield superior results (Krishnan and Jha, 2011).

Although, customers have been regarded as the most important external source of knowledge for the innovation process (Hartley and Choi, 1996), research continued to debate on their impact on the types of innovation strategies (product or process), the stage of knowledge management (Liao and Barnes, 2015) and the influence on different aspects of performance. Research in innovation strategy has tended to examine mainly new product development rather than improvement in processes (Tsinopoulos, 2018; Fuchs and Schreier, 2011). The innovation–performance relationship has often been unclear, thus calling for the need to conduct further studies to investigate the linkage between different types of innovation and performance (Damanpour and Aravind, 2012). It has been stated that the effects of innovation types on the operational performance of manufacturing companies are under-investigated (Al-Se’di et al., 2017). Due to the same reason, product innovation has a prevailing exposure to research due to visibility and, more directly, to financial influences. However, process innovation equally requires attention in customer knowledge as in costs reduction and efficiency matters.

The concept of CL has been extensively examined for their acquisition, storage and transfer. Anne Jalkala (2010) use the concept of leveraging customer in marketing philosophy to enable loyal customers to become part of the sales and marketing team, however, there is scarce mention that the focal firm convert this knowledge into product design or process changes. Tsai et al. (2011) indicated that the extant literature may demonstrate bias because of the one-way communication used in addressing customers’ knowledge acquisition. After reviewing 45 papers in the area of knowledge management and innovation, Costa and Monteiro (2016) concluded that knowledge acquisition and knowledge sharing are the most frequently studied processes. According to the knowledge-based view (KBV), the real value of both individual and organizational knowledge exists when knowledge is applied because of implicitness of knowledge (Hossain et al., 2016). Thus, more research is needed to elaborate the usage and application of customer knowledge and the impact on processes and performance. Especially, managers need more guidance on how companies can effectively apply customer knowledge in response to the increasing turbulent business environment.

This current study addresses the above by defining the concept of CL below, and examining its relationship with process innovation and performance (financial and cost measures). This study investigates the following questions:

**RQ1.** To what extent does CL affect customer-firm innovation processes?

**RQ2.** How do these value dimensions of CL impact costs and financial outcomes?

**RQ3.** How is the relationship between CL and process innovation influenced by the dynamics of the markets?

It is intended that findings of this empirical study would provide better understanding on how customer knowledge contributes to process innovation and the effects on performance. For supply chain and operations management practitioners, the study demonstrates the
importance of linkages between marketing and operations management in enhancing process innovation in the whole supply chain. A deeper understanding of the performance outcomes associated with process innovation allows organizations, especially small manufacturing firms, to better decide when, how much, and where to invest resources to enhance performances. Furthermore, the current study contributes to the existing literature by investigating the proposed relationships in a more global context with 10 countries, representing different stages of economic development.

The paper is set out as follows. The first section provides theoretical background from process innovation and customer-buyer relationship literature. Next, the study provides the development of the research model and hypotheses. The study design section describes methods and findings. The last section offers interpretations, contributions and limitations.

2. Theoretical background and research hypotheses

In this section, the literature is reviewed to define CL, its relationship to process innovation and performance measures. The conceptual framework and hypotheses are then derived from this literature review, in particular, the theory of KBV and transaction cost economics (TCE).

2.1 Customer leverage (CL) and performance

There exist three streams of research that examine customer knowledge. The first stream focuses on the importance of acquisition (Drechsler and Natter, 2012; West and Bogers, 2014). The second line of research into CL highlights the importance of in sharing knowledge (Peng Wong and Yew Wong, 2011; Wong et al., 2013) and the third area of research offering opportunity for improvement (Wagner and Bode, 2014; Wang et al., 2016). Liao and Barnes (2015) classified general knowledge into acquisition, sharing and application stages. A number of terminologies have been used in literature describing the process of customer knowledge management, customer relationship management (CRM) (Thakur and Workman, 2016), customer references (Anne Jalkala, 2010), customer co-creation (Thakur and Workman, 2016), external knowledge management (Revilla and Villena, 2012) and customer intimacy (Garvin, 1995). CRM is an important tool for creating a strong relationship between the company and its customers. It is where the firm’s extended working relationship with its customers is important for the maintenance of a healthy business and the success of an organization. Co-creation with customers has recently been suggested to be a major source for firms’ competitive advantage (Thakur and Workman, 2016). Gamal Aboelmaged (2012) reviewed customer knowledge articles involving customers in the innovation process, indicated that the company can obtain specific information about needs and desires, and translate these into concrete product specifications (Kaplan and Haenlein, 2006). Recent literature (Costa and Monteiro, 2016) concluded that knowledge acquisition and knowledge sharing are the most frequently studied knowledge processes.

Taking the tenets from three streams, this study defines a firm’s customer leveraging capability as the extent of the focal firms’ usage of their obtained knowledge from customers in developing new products and services, and in improving processes (Thakur and Workman, 2016). Whereas leverage in strategic business means enhancing the firm resources and capabilities to increase its competitive advantage. From a resource-based view (Barney, 1991), process innovation provides organizations with a “hidden” competitive advantage that cannot be easily imitated, as the blended internal-external knowledge on which this innovation is based is exclusive. Therefore, firms can combine customer knowledge and leverage process innovations as a strategic resource, thereby increasing entry barriers for competitors hence protecting the firms’ market advantage (Smagalla, 2004).
Obtaining and acquisition of customer knowledge and knowhow enhances the firm’s ability to respond to technical changes and market fluctuation. Sharing of customer knowledge could lead to reduced uncertainty and enrich the overall body of knowledge. Managing external knowledge is the process of capturing, developing, sharing and effectively making the best use of external knowledge (Hojnik and Ruzzier, 2016). However, companies are encouraged to move beyond just acquisition and sharing customer knowledge, towards integrating the knowledge learnt from customers into redesign and improvement of existing processes (Leonard-Barton, 1995). Changes in market demand occur rapidly, and it would be useful if firms use customer knowledge in their internal knowledge creation processes (Grant and Baden-Fuller, 2004). This requires knowledge integration across the boundaries of the firm. From a TCE perspective, CL can be regarded as a relationship-specific investment by exchange parties (Wagner and Bode, 2014) that can reduce uncertainty, potential conflicts and discourage efforts to seek a private advantage (Williamson, 1979). CL provides the firm’s capability to respond faster to technological changes (Thakur and Workman, 2016) and to reduce risk and opportunistic behavior. Opportunism mitigation reduces transaction costs in negotiating, monitoring and safeguarding the involved parties’ behavior. When opportunistic behavior can be restrained through an open sharing innovation, coordination cost and uncertainty between exchange parties are also reduced (Stump and Heide, 1996), resulting in improved manufacturers’ performance. Therefore, learning and applying knowledge from customers in response to market changes and technological innovation can reduce uncertainty and opportunism in the ongoing partnerships with customers, thus lowering transaction costs. Thus, this study argues that:

H1. A manufacturer’s customer leveraging capability exerts a direct positive effect on cost efficiency.

The usage of customer knowledge in both product and process innovation can help firms application of new knowledge and aspects that would otherwise have been lost. Customer knowledge, a special form of external knowledge, promotes engagement and collaboration in innovations (Chen and Huang, 2009). The benefits of this social capital from engagement and collaboration are multi-fold. Transactional cost economics suggests that firms are able to reduce production cost and reach greater economies of scale by pooling resources together (Williamson, 1979). CL knowledge acquisition gives companies the opportunity to improve their processes and to transform the existing or internal knowledge into new knowledge (Chen and Huang, 2009). Consequently, the new acquired knowledge contributes efficiently to maximize the available stocks of knowledge and minimize the uncertainty. Furthermore, customer knowledge could facilitate the process of sensing the new innovation as customers and also as end users. The latter would know the most about the market, thus enlarging market share and creating new engines for growth. This social capital can directly influence the performance such as market share and cost reduction. Collectively, these capabilities suggested that the new obtained customer knowledge provides opportunities for creating innovative processes resulting in operations efficiency and future market share. Accordingly, this study proposes that:

H2. A manufacturer’s customer leveraging capability exerts a direct positive effect on financial performance.

2.2 Mediating roles of process innovation between CL and performance

There are several linkages between customer knowledge and innovation processes. The role of customer knowledge in directly enhancing operational performance has been discussed in the above sections. Additionally, this study argues that the effect of customer knowledge on
performance will be greater in organizations involved in process innovations. This means that, in addition to the direct effect of customer knowledge on performance, an indirect effect exists through process improvement and process innovation. This indirect effect exists due to real exploitation of organizational resources, and knowledge capability provides organizations with the ability to design efficient (cheaper) and innovative processes that contribute to improving quality, flexibility and delivery and reducing cost (Chin-Yen and Tsung-Hsien, 2007).

First, CL exerts a positive impact on process innovation. Manufacturing firms have an incentive to build on the customers’ innovation suggestions because they will likely guarantee eventual customer acceptance and market fit. In return, these customers can benefit from new or improved processes (i.e. resulting in better service or lower cost) or new or improved products (e.g. resulting in more innovative product offerings and higher sales) (Faems et al., 2005). In sum, innovation suggestions that are pulled by customers will likely be beneficial for the manufacturing firms and lead to innovative product or process innovations. Theoretically, customer knowledge creates social capital between customers and innovation developers (Yang, 2014). Investments in these relationships enhance understanding of customer experiences, perception, demand, expectations, and preferences that can be effectively leveraged by the innovation developers, such as R&D teams (Rosell et al., 2014). These investments are non-recoverable expenditures a firm makes to support a specific inter-organizational relationship with another firm (Wagner and Bode, 2014). Manufacturing firms that leverage customer knowledge are more likely to modify its own process innovations to the corresponding customers. After having deployed CL, a manufacturer seeks to earn the returns on its investment and is therefore interested in sustaining a long-term relationship with the corresponding customer firm. The process innovations could be a possible means to strengthen the relationship, because the buying firm benefits from process innovations such as quality improvements and cost reductions on the buying firm’s side (Kim, 2000). Collectively, the above support the following hypothesis:

H3. CL has a positive relationship with process innovation.

Second, in the resource-based view, resources that are rare, valuable, difficult to substitute, and imperfectly imitable will contribute to sustainable performance and competitive advantage (Barney, 1991). Therefore, process innovations have an advantage over product innovations since they are often hidden internally within organizations which make them difficult to be imitated by competitors (Teece, 1986). Firms focusing on process innovations are able to compete in mature markets where the state of the art of the products is already well established, and the primary focus is to make and deliver products (which could be similar to competitors) to customers with higher values, such as faster, more flexible, or cheaper (Congden and Schroeder, 1996). In addition, Oke and Kach (2012) proved that process innovation effectively improves internal production operations resulting in decreased cost and improved manufacturing performance. When firms learn more about new processes before their competitors, they can save more resources in producing a similar product. Those manufacturers, who are first within the industry to apply these new processes, will be foremost in adding value, relative to their competitors. Most studies argue that customers possess unique knowledge about their preferences (Poetz and Schreier, 2012), and therefore, it is reasonable to expect their involvement increases success in terms of product–customer needs fit (Alam and Perry, 2002), consequently in financial measures such as profit (Lau et al., 2010), or market share (Joshi and Sharma, 2004). Thus, this study proposes that (Figure 1):

H4. Process innovation strategy has a positive relationship with costs.

H5. Process innovation strategy has a positive relationship with financial performance.
On the other hand, although previous literature agrees that there is a positive impact of knowledge management capability on a firm’s innovation performance (Tsai et al., 2013), the mediating role played by innovation process in the relationship between knowledge management capability and operations performance has not yet been empirically revealed (Liao and Barnes, 2015). While firms may acquire, share, and apply knowledge to improve operations strategy, they may need to possess a higher level of process innovation to ensure effective outcomes of such integration. These joint activities are influenced, either directly or indirectly, by the choices and alignment efforts of members in the supply chain (Handfield and Nichols, 2002). Thus, the question is why are some firms successful at this leveraging whereas others are not? The next sections discuss contextual factors affecting the relationship between CL and process innovation.

### 2.3 Moderating roles of market dynamics

While innovation studies have shown the effectiveness of innovation as a competitive strategy, they also suggest that such effectiveness is influenced by the environmental context in which the firm operates and competes (Tsai et al., 2013). This is because the innovation strategies which are effective in improving performance in certain environments may not be as effective in other environments (Prajogo, 2016). Therefore, the primary objective of this section is to examine the moderating roles of market dynamics on the effectiveness of linkages between customer knowledge and process innovation in delivering cost and financial performance. This study focuses on market dynamics (Covin and Slevin, 1989), which are characterized by the constant rate of change in demand, inputs or technology. The reason for this selection is that in such business environments, firms tend to innovate to satisfy changing customer preferences and secure competitive advantage (Lumpkin and Dess, 2001).

The effect of CL on process innovation and firm performance is a multi-faceted issue which might require a contingency perspective (Sousa and Voss, 2008). Firms with more stable markets might deploy the process incremental or exploitative innovation (Wang et al., 2015) whereas exploratory innovation is more speculative and focused on changing market dynamics. Economic theory lends empirical support that higher levels of market dynamics are associated with introducing new processes more frequently (Utterback and Abernathy, 1975). This allows a manufacturer to align operations with changing customer requirements, develop unique capabilities that can reduce costs and lead times associated with customization, and benefit from market dynamics (Liu et al., 2012). In an aggressive technological environment, firms need to tap into external knowledge (e.g. customer knowledge) and draw deeply from partners along the supply chain. This allows them to increase performance in terms of the reduction of risks (Oliver et al., 2010), costs and time...
(Kolk and Punmann, 2008), as well as in the introduction of new or significantly improved products, services and processes (Ferreira et al., 2015). Thus, this study hypothesizes that:

\[ H6. \text{Market dynamics strengthens the positive relationship between CL and process innovation.} \]

3. Research design and associated analyses

3.1 Research design

The data collection was done via e-mail using an interactive PDF questionnaire which targeted production and manufacturing managers as key respondents. This questionnaire was developed through the Global Manufacturing Research Group (GMRG) project conducted in 2014. The questionnaire distributed to the sample firms was developed in a rigorous process by key operations management scholars (Whybark et al., 2009). The first section of the questionnaire pertains to general information of the business unit (i.e., company size, industry, production network configuration, competitive strategy and process innovation) within the context in which manufacturing takes place, whereas the other sections refer to the plant’s most important product line, focusing on manufacturing strategies, practices and performance. The plant’s most important product line refers to the product line that generates the most revenue for the plant. The plant is chosen as the unit of analysis in order to avoid problems related to business units with multiple plants operating in different ways. All research teams in the GMRG group follow a standard data collection protocol. The research team made telephone calls to potential plants and mailed or emailed questionnaires to those that agreed to participate in the survey. Follow-up telephone calls were made to improve the response rate.

Table I provides the company profiles in this study. The sample consists primarily of small and medium-sized companies (74.6 percent) of the sample. Included in the survey are more than twenty manufacturing industries, which represent foods, garment and textile, chemical, furniture, metal products, semiconductor, electrical machinery, precision instrument, automotive and other transport industries. It can be seen that emerging industries in China, Korea and Taiwan have made significant investments in new processes compared to other developing and developed countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Frequency</th>
<th>Percent</th>
<th>Ave. GDP per capita</th>
<th>R&amp;D budget (%)</th>
<th>Investment new process (%)</th>
<th>Training staff (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Developed</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>10</td>
<td>1.53</td>
<td>$65,600</td>
<td>0.51-0.75</td>
<td>5-8</td>
<td>1.1-1.5</td>
</tr>
<tr>
<td>Korea</td>
<td>72</td>
<td>11.1</td>
<td>$45,091</td>
<td>0.76-1</td>
<td>9-12</td>
<td>1.6-2</td>
</tr>
<tr>
<td>USA</td>
<td>83</td>
<td>12.8</td>
<td>$52,392</td>
<td>0.51-0.75</td>
<td>5-8</td>
<td>1.1-1.5</td>
</tr>
<tr>
<td><strong>Emerging</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>31</td>
<td>4.8</td>
<td>$13,403</td>
<td>0.26-0.50</td>
<td>1-4</td>
<td>0.51-1</td>
</tr>
<tr>
<td>India</td>
<td>54</td>
<td>8.3</td>
<td>$1,548</td>
<td>0.51-0.75</td>
<td>5-8</td>
<td>1.1-1.5</td>
</tr>
<tr>
<td>China</td>
<td>27</td>
<td>4.2</td>
<td>$8,626</td>
<td>0.76-1</td>
<td>9-12</td>
<td>1.6-2</td>
</tr>
<tr>
<td>Poland</td>
<td>71</td>
<td>10.9</td>
<td>$13,760</td>
<td>0.26-0.50</td>
<td>1-4</td>
<td>0.51-1</td>
</tr>
<tr>
<td>Taiwan</td>
<td>40</td>
<td>6.2</td>
<td>$31,900</td>
<td>0.51-0.75</td>
<td>5-8</td>
<td>1.1-1.5</td>
</tr>
<tr>
<td><strong>Developing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Croatia</td>
<td>111</td>
<td>17.1</td>
<td>$13,490</td>
<td>0.26-0.50</td>
<td>1-4</td>
<td>0.51-1</td>
</tr>
<tr>
<td>Vietnam</td>
<td>151</td>
<td>23.2</td>
<td>$1,868</td>
<td>0.51-0.75</td>
<td>5-8</td>
<td>1.1-1.5</td>
</tr>
<tr>
<td>Total</td>
<td>650</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Table I. Respondent country profiles

Moderating effects from market dynamics
3.2 The research constructs and reliability, convergent validity and discriminant validity tests

The section of the questionnaire related to this research study is displayed in Table II. A combination of perceptual and objective measures was used to capture the responses and to limit common method bias. The model includes process innovation construct, which focuses on firms’ ability to learn more about new processes than their competitors; to be first within the industry in applying new processes; and to be updated with the latest processes (Malhotra et al., 2007; Menor et al., 2007). CL focuses on the manufacturer’s extent in obtaining, acquiring and applying new customer knowledge (Choi et al., 2002). Financial performance was measured objectively based on market share, revenue and profit increased relative to competitors (Choi et al., 2002).

First, the internal consistency reliability test revealed that Cronbach’s α ranged from 0.701 (process innovation) to 0.882 (financial performance), which exceeds 0.60, the threshold value (Hair et al., 2010). Table II provides constructs’ mean of measurement items, standard deviation, loading and p-values. Second, the confirmatory factor analysis (CFA)

<table>
<thead>
<tr>
<th>Research measurements</th>
<th>Estimate</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs (α = 0.823)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total product unit costs</td>
<td>0.71</td>
<td>4.39</td>
<td>1.20</td>
</tr>
<tr>
<td>Raw material unit costs</td>
<td>0.85</td>
<td>4.48</td>
<td>1.22</td>
</tr>
<tr>
<td>Product performance</td>
<td>0.69</td>
<td>4.46</td>
<td>1.14</td>
</tr>
<tr>
<td>Financial performance (α = 0.848)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sales</td>
<td>0.85</td>
<td>4.34</td>
<td>1.21</td>
</tr>
<tr>
<td>Profitability</td>
<td>0.88</td>
<td>4.28</td>
<td>1.02</td>
</tr>
<tr>
<td>Market share</td>
<td>0.71</td>
<td>4.32</td>
<td>1.13</td>
</tr>
<tr>
<td>Market competitive intensity (α = 0.738)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There are many substitutes in the market for your products</td>
<td>0.76</td>
<td>4.50</td>
<td>1.23</td>
</tr>
<tr>
<td>Demand for your products is difficult to predict</td>
<td>0.67</td>
<td>4.36</td>
<td>1.02</td>
</tr>
<tr>
<td>Suppliers of critical inputs have significant bargaining power</td>
<td>0.70</td>
<td>4.40</td>
<td>1.28</td>
</tr>
<tr>
<td>Your industry is subject to rapid technological change</td>
<td>0.68</td>
<td>4.20</td>
<td>1.31</td>
</tr>
<tr>
<td>Process innovation (α = 0.701)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We are learning more about the newest processes than our competitors</td>
<td>0.79</td>
<td>4.18</td>
<td>1.52</td>
</tr>
<tr>
<td>We are the first within the industry to deploy new processes</td>
<td>0.77</td>
<td>4.80</td>
<td>1.33</td>
</tr>
<tr>
<td>We keep up with the latest process developments</td>
<td>0.73</td>
<td>5.06</td>
<td>1.40</td>
</tr>
<tr>
<td>Process innovation is important to this plant</td>
<td>0.70</td>
<td>4.23</td>
<td>1.23</td>
</tr>
<tr>
<td>We frequently introduce processes that are radically different from</td>
<td>0.61</td>
<td>4.33</td>
<td>1.39</td>
</tr>
<tr>
<td>We have no difficulty in introducing processes that are radically different from existing processes in the industry</td>
<td>0.71</td>
<td>4.23</td>
<td>1.26</td>
</tr>
<tr>
<td>Customer leverage (α = 0.832)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We are able to obtain a tremendous amount of technical knowhow from our customers</td>
<td>0.65</td>
<td>4.43</td>
<td>1.14</td>
</tr>
<tr>
<td>We rapidly respond to technological changes in our industry by applying what we know from our customer</td>
<td>0.72</td>
<td>4.63</td>
<td>1.26</td>
</tr>
<tr>
<td>As soon as we acquire new knowledge from our customer, we try to find applications for it</td>
<td>0.65</td>
<td>4.36</td>
<td>1.21</td>
</tr>
<tr>
<td>Our key customer’s technological knowledge enriched the basic understanding of our innovation activities</td>
<td>0.88</td>
<td>4.51</td>
<td>1.02</td>
</tr>
<tr>
<td>Our key customer’s technological knowledge reduced the uncertainty of our innovation activities</td>
<td>0.85</td>
<td>4.52</td>
<td>1.06</td>
</tr>
<tr>
<td>Our key customer’s technological knowledge helps us to identify new aspects of innovation activities that would otherwise have gone</td>
<td>0.81</td>
<td>4.26</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Table II. Constructs means and reliability measures

Notes: RMSEA, root mean square error of approximation; GFI, goodness of fit index; CFI, Comparative Fit Index. χ² = 205.8; df = 111; χ²/df = 1.85; CFI = 0.985; NFI = 0.973; RMSEA = 0.036. The scale format for each of these measures was 1 = strongly disagree to 7 = strongly agree.
measurement models confirmed the presence of five unique constructs, and their CFA details are presented in Table III. The model fit indices were \( \chi^2/df = 1.85 \), which lies in the recommended range of 1–3. Further, the RMSEA value of 0.036 suggests a good model fit. The results in Table III showed that all of the average square root values (AVE) were higher than the correlations, again indicating acceptable discriminant validity. In addition, both max shared variance (MSV) and average shared variance (ASV) values are smaller than AVE (Hair et al., 2010).

3.3 Hypothesis testing
A structural equation model was used to test the hypotheses. The fit indices indicate a good model fit as shown in Table IV. Table IV displays the directions and significance of the hypothesized relationships among the constructs. The results supported \( H1–H5 \), which confirmed the positive impacts of process innovation on both costs and financial measures; where CL strongly support costs (\( H1 \)) but not financial performance (\( H2 \)). The results supported \( H1 \) confirming significant gains on process innovation from CL.

3.4 Moderating effects by market dynamics (\( H6 \))
\( H6 \) suggested that process innovation will be pursued with different emphases based on the degree of market dynamics. A moderated regression analysis was run to test the hypothesis. This procedure also provides further refining results supporting the structural models (see Table IV). Table V confirms that CL strongly supports process innovation (\( \beta = 0.47 \) at \( p < 0.001 \)). The moderating effects were tested by creating the product terms between these variables using their standardized scores. The dependent variable, process innovation, is jointly determined by the interaction of the predictors (Market dynamics \( \times \) CL). The findings show that market dynamics strengthens the positive relationship between CL and process innovation (\( \beta = 0.12 \) at \( p < 0.05 \)). Therefore, \( H6 \) is supported. The results of the collinearity diagnostic test on the regression model show that the variance inflation factor

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</tr>
</thead>
<tbody>
<tr>
<td>[1] Costs</td>
<td>0.796</td>
<td>0.114</td>
<td>0.071</td>
<td>0.568</td>
<td>0.754</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[2] Process innovation</td>
<td>0.837</td>
<td>0.200</td>
<td>0.101</td>
<td>0.508</td>
<td>0.263**</td>
<td>0.713</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[3] Customer leverage</td>
<td>0.892</td>
<td>0.200</td>
<td>0.102</td>
<td>0.582</td>
<td>0.256**</td>
<td>0.447**</td>
<td>0.763</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[4] Market dynamics</td>
<td>0.675</td>
<td>0.107</td>
<td>0.052</td>
<td>0.506</td>
<td>0.185*</td>
<td>0.261**</td>
<td>0.327**</td>
<td>0.716</td>
<td></td>
</tr>
<tr>
<td>[5] Financial performance</td>
<td>0.853</td>
<td>0.114</td>
<td>0.054</td>
<td>0.662</td>
<td>0.337**</td>
<td>0.258**</td>
<td>0.186**</td>
<td>0.025</td>
<td>0.814</td>
</tr>
</tbody>
</table>

Notes: Diagonal elements (in italic) are the square root of the average variance extracted (AVE) between the constructs and their measures. Off-diagonal elements are correlations between constructs. For discriminate validity, AVE should be greater than off-diagonal elements. *,**Significant at 0.01 and 0.001

<table>
<thead>
<tr>
<th>Relationship of research constructs</th>
<th>Estimate</th>
<th>SE</th>
<th>CR</th>
<th>( p )</th>
<th>Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs ← Customer leverage</td>
<td>0.150</td>
<td>0.040</td>
<td>2.717</td>
<td>0.007</td>
<td>( H1 )-Supported</td>
</tr>
<tr>
<td>Financial ← Customer leverage</td>
<td>0.013</td>
<td>0.063</td>
<td>0.269</td>
<td>0.788</td>
<td>( H2 )-Rejected</td>
</tr>
<tr>
<td>Process Inno ← Customer leverage</td>
<td>0.477</td>
<td>0.048</td>
<td>9.465</td>
<td>***</td>
<td>( H3 )-Supported</td>
</tr>
<tr>
<td>Costs ← Process Inno.</td>
<td>0.294</td>
<td>0.046</td>
<td>4.932</td>
<td>***</td>
<td>( H4 )-Supported</td>
</tr>
<tr>
<td>Financial ← Process Inno.</td>
<td>0.350</td>
<td>0.071</td>
<td>6.532</td>
<td>***</td>
<td>( H5 )-Supported</td>
</tr>
</tbody>
</table>

Notes: \( \chi^2 = 300.251; \ df = 158; \chi^2/df = 1.900; \ CFI = 0.986; \ NFI = 0.957; \ RFI = 0.941; \ RMSEA = 0.031. \ CR, composite reliability; ***\( p = 0.001 \)

Table III. Correlation matrix and construct validity measures

Table IV. Results of the hypothesis testing
values range between 1.06 and 1.45 (well below 10); thus, confirming the absence of multicollinearity problems in the data set. The interaction and the mixed impacts on process innovation are presented in Figure 2.

3.5 Mediating roles of process innovation

In the proposed conceptual model, process innovation is mediating the effects of the CL on manufacturing performance (costs and financial performance). Structural equation models with bootstrapping procedures (Mallinckrodt et al., 2006) were used to test for such mediation effects. Table VI indicated the outcomes, which show the direct effects with and without mediator. The test of the indirect effects between CL → process innovation → costs and CL → process

<table>
<thead>
<tr>
<th>Mediator process innovation</th>
<th>Direct with mediator</th>
<th>Indirect</th>
<th>Mediation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer leverage to costs</td>
<td>0.100 (0.096)*</td>
<td>0.119 (0.005)**</td>
<td>Partial</td>
</tr>
<tr>
<td>Customer leverage to financial perf</td>
<td>0.045 (0.398)n/s</td>
<td>0.153 (0.009)**</td>
<td>Full</td>
</tr>
</tbody>
</table>

Notes: *,**Significant at 0.01 and 0.001, respectively

Table VI. Results of the mediating effects
innovation → financial performance were all significant at 0.01 level. Interestingly, the direct effects (CL → financial performance) were not significant (β = 0.045, p = 0.398). Interestingly, the mediating effect of process innovation is fully on financial performance, but partially on costs. The next section provides more discussion on these findings.

4. Discussion and implication
This study examined the linkages between a marketing concept, CL and manufacturing performance via process innovation, which in turn affect cost efficiency and the firm’s financial performance. Drawing upon the KBV, this study confirmed that CL has a strong influence on process innovation, where co-created knowledge between customers and manufacturers is able to reconfigure the existing processes to respond rapidly to the unpredictable and turbulent market. Where demand is unpredictable and customer and technological factors change frequently, the effect of perceived customer perception and its accumulative knowledge on process innovation can vary significantly. Process innovation, on the other hand, exerts a mediating effect between CL and performance, including both cost efficiency and financial measures, grounded in TCE. Collectively, the results shown above provide support to the argument of the importance of leveraging customer knowledge in enhancing process innovation and performance.

From a theoretical perspective, these results extend the limited existing research on global manufacturing context that customer knowledge forms an effective source for increasing innovative processes and enhancing the ability of manufacturing companies to adapt in new and different markets. These results are consistent with previous studies (Anne Jalkala, 2010; Liao and Barnes, 2015) that customer knowledge is a source for innovation strategies. This finding asserts that, in the manufacturing context, customer knowledge is an essential factor to enhance process innovation. This confirms previous literature that asserted the important role of customer knowledge to improve processes, reduce production costs (Mafabi, 2012), and improve quality of the products (Slavković and Babić, 2013), ultimately leading to sustainable competitive advantage (Maria Ruiz-Jiménez and del Mar Fuentes-Fuentes, 2013).

This study defines a firm’s customer leveraging as the extent the focal firms depend on customers in developing new product, services and improving processes. The findings confirm that the speed and frequency of applying the acquired knowledge from customers will potentially decrease competitive uncertainty and thus lead to improved process innovation. In essence, CL plays a significant role as “business intelligence” in closing the gaps in traditional marketing and initiates process changes through organizational boundaries.

The higher the market turbulence, the stronger the pressures for CL demanded by process innovation. The results of moderating effects from market dynamics on the relationship between CL and process innovation (e.g. Table V and Figure 2) have shown that in dynamic markets (characterized by many substitutes, fluctuating demand and rapid technological change) investments through CL could help push process innovation to adapt to market changes. These findings enhance the understanding of the important role of knowledge management in supply chain management, especially when the market is fluctuating (Abrell, 2016; Revilla and Villena, 2012).

The results in Table VI confirmed that process innovation plays a mediating role in absorbing and transforming customer knowledge in improving costs and financial measures. This is an important result that highlights the mechanism by which customer knowledge can influence a firm’s bottom line. Previous research has also found that CRM does not affect firm performance directly. Rather, the CRM–performance link is fully mediated by differentiation and cost leadership strategies (Reimann et al., 2010). Interestingly, the results emphasized the essential role of CL in reducing costs (accepted H1), but not overall financial measures (rejected H2). This result is consistent with previous
studies that found a positive effect of CRM on some performance measures (Anne Jalkala, 2010; Lee and Kim, 2010) although not directly (Reimann et al., 2010). The possible explanation for these counterintuitive findings is that firms in a mature market tend to look for improving the existing processes and more efficiency oriented matters, rather than growth and market share objectives (Bonanno and Haworth, 1998).

5. Managerial implications
The findings of this current study offer several implications for managers. Prior research has helped managers to understand the factors that enable them to successfully pull innovations from their customers (Al-Sadi et al., 2017; Wagner and Bode, 2014). This current study complements this view by demonstrating that it is also important for managers to understand how to integrate them into process innovation and which market conditions are expected to give rise to a greater manufacturing performance.

First, this study shows that managers in manufacturing companies should place more emphasis on customers, understanding their requirements and needs when considering process improvement. The knowledge acquired from external sources such as customers and other organizations is a valuable source of innovations (Liao and Barnes, 2015). Beyond that managers should reinforce leveraged external knowledge not just by acquiring and sharing, but also applying new ideas from customers as soon as possible. This study asserts that those with “first to market” attitude and continuous updating from customers will gain significant process improvement, eventually reducing costs and improving financial outcomes. Effective intra-organizational knowledge management depends on two factors: the timely and accurate communication of this knowledge to appropriate managers and the application of this knowledge for strategic decisions.

Second, these findings provide managerial suggestions on how to match the external business environment with innovation processes. The results from this study asserts that the higher the market turbulence, the stronger the pressures for CL demanded by process innovation. Thus, managers should be well prepared when observing markets with demand fluctuations, characterized with many substitutes; rapid technological change and high supplier power. Specifically, this is the best time to seek feedback from existing customers within the supply chain on technical knowhow and their understanding of the firm’s processes. Parallel to that, this study recommends to quickly find applications from their learning from customers. Therefore, building and integrating both process innovation and CL would equip firms in facing the dynamics of the markets, and navigating through the changing conditions of business environments.

Finally, the findings also confirm that process innovation plays a mediating role in absorbing and transforming customer knowledge in improving costs and financial measures. This is an important result that suggests a mechanism by which managers can leverage customer knowledge to expect a greater performance. This research urges managers to try to be the first to apply customer knowledge into process changes. It supports previous research that purports by adopting advanced manufacturing and information technologies as well as developing new processes and/or frequently introducing new processes that are radically different, the flexibility and responsiveness of operations can substantially improve, thereby enhancing dynamic capability (Rungtusanatham and Salvador, 2008).

6. Limitations and future research
The results of this study are subject to several limitations. First, this study was conducted for manufacturing organizations across different industries, thereby potentially resulting in a greater source of variance, with the generalizability of this study’s findings to other types of industry sectors other than manufacturing being quite limited. Hence, future researchers
may replicate and extend this study to sectors other than manufacturing. Second, the data points were collected from single sources (i.e. CEOs or supply chain managers). Although they were considered to be the more relevant informants, the most desirable data collection procedure would have used a design of multiple respondents.

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Towards Industry 4.0
Mapping digital technologies for supply chain management-marketing integration

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Politecnico di Bari Dipartimento di Meccanica Matematica e Management, Bari, Italy

Abstract
Purpose – The purpose of this paper is to present a comprehensive picture of the innovative efforts undertaken over time to develop the digital technologies for managing the interface between supply chain management and marketing processes and the role they play in sustaining supply chain management-marketing (SCM-M) integration from an information processing point of view.
Design/methodology/approach – Patent analysis and actual examples are used to carry out this study. In detail, first, the authors identify the subset of enabling technologies pertaining to the fourth industrial revolution (Industry 4.0) that can be considered the most relevant for effective SCM-M integration (i.e. Industrial Internet of Things, Cloud computing, Big Data analytics and customer profiling, Cyber security). Second, the authors carry out a patent analysis aimed at providing a comprehensive overview of the patenting activity trends characterizing the set of digital technologies under investigation, hence highlighting their innovation dynamics and applications.
Findings – This research provides insightful information about which digital technologies may enable the SCM-M integration. Specifically, the authors highlight the role those solutions play in terms of information acquisition, storage and elaboration for SCM-M integration by relying on illustrative actual examples. Moreover, the authors present the organisations more involved in the development of digital technologies for SCM-M integration over time and offer an examination of their technological impact in terms of influence on subsequent technological developments.
Originality/value – So far, much has been said about why marketing and supply chain management functions should be integrated. However, a clear picture of the digital technologies that might be adopted to achieve this objective has yet to be revealed. Thus, the paper contributes to the literature on SCM-M integration and Industry 4.0 by highlighting the enabling technologies for the Industry 4.0 that may particularly serve for managing the SCM-M interface from an information processing perspective.

Keywords Innovation, Marketing, Internet of Things, Patent analysis, Cloud computing, Supply chain management, Big Data analytics, Industry 4.0, Cyber security, Supply chain management-marketing integration, Customer profiling

Paper type Research paper

1. Introduction
Creating customer value is pivotal for firm survival and the achievement of superior financial performance (Woodruff, 1997; Lindman et al., 2016). Although this activity is especially enabled by the marketing function, it is further supported by functional areas that are not conventionally associated with marketing, as the supply chain management (SCM) function (Jüttner et al., 2007; Trkman et al., 2015). In fact, on the one hand, the marketing function is necessary to keep pace with the volatile demand characterising current markets and identify the most valuable products to offer (e.g. Slater and Narver, 1995). On the other hand, the SCM function, which is responsible for the management of supply-focussed processes (e.g. operations and inbound/outbound logistics), is also needed to effectively deliver value to customers since it lets companies maintain high service levels and avoid stock-outs (e.g. Esper, Defee and Mentzer, 2010; Macchion et al., 2015). Thus, it has been argued that the ability of firms to integrate and coordinate SCM and marketing functions, i.e., supply chain management-marketing (SCM-M) integration, is important to reduce mismatches between demand and supply of relevant products for a given market (Pero and Lamberti, 2013; Jüttner et al., 2010).
Firms that can manage the SCM-M interface are deemed to outperform companies that create differential advantages in only one of the marketing or SCM function (Boyer and Hult, 2005; Esper, Ellinger, Stank, Flint and Moon, 2010; McKinsey & Co, 2017a). Yet, the current organisational practice still lacks a comprehensive understanding of the tools supporting the information processing mechanisms that allow serving customers with the appropriate products, while reducing the constraints that emerge throughout supply chain transactions (Esper, Ellinger, Stank, Flint and Moon, 2010; Alvarado and Kotzab, 2001). Notably, the key to success for SCM and marketing functions is the acquisition, exchange, and elaboration of market and operational knowledge in a timely manner (Esper, Ellinger, Stank, Flint and Moon, 2010; Mentzer, 2001; Slater and Narver, 1995; Bhosale and Kant, 2016). Thereby, information processing mechanisms are considered of foremost importance to effectively manage the interface between SCM and marketing processes.

To improve information processing mechanisms, academics, executives and policymakers are calling for a digital transformation of companies, as suggested by the principles of the fourth industrial revolution (Industry 4.0) (Kagermann et al., 2013; Theorin et al., 2017; Deloitte, 2015). Accordingly, in the vision of the Industry 4.0, the digitisation of firm processes may facilitate the integration of firm functions and supply chain members, so that “the chain becomes a completely integrated ecosystem that is fully transparent to all the players involved—from the suppliers of raw materials, components, and parts, to the transporters of those supplies and finished goods, and finally to the customers demanding fulfilment” (Schrauf and Bertram, 2016, p. 4). The adoption of certain “enabling technologies” (e.g. information systems and improved Big Data analytics techniques) is necessary to accomplish this digital transformation. However, the implementation of digital supply chains and more advanced marketing techniques is hindered by the high investments and important challenges related to the digitisation process (Ranganathan et al., 2011; Melville, 2010). One the most relevant determinants of digitisation costs is the inability to actually screen and select the available technologies that may sustain the digitisation process and, thus, SCM-M integration. Indeed, an integrative view of the enabling technologies required to digitise firm processes, such as SCM-M integration, has been loosely defined; moreover, information about the available technologies for SCM-M integration, their development trends, and their technological impact is still scant, ultimately limiting the possibility of firms to have a complete overview of the most relevant solutions to adopt (Deloitte, 2015; McKinsey & Co, 2015). Therefore, the present paper aims at filling this gap in the literature by providing a comprehensive overview of the digital technologies, and the role they play, for managing the interface between SCM and marketing processes and presenting a complete picture of the innovative efforts undertaken over time to develop those solutions. That is, according to the notion that some digital technologies support the Industry 4.0 from an information processing perspective (Jüttner et al., 2007), we aim at elucidating which digital technologies are especially suitable for SCM-M integration and their application.

Starting from the list of digital technologies enabling the Industry 4.0 (Calenda, 2016; PwC, 2016; Rüßmann et al., 2015), we identify those that may best support SCM-M integration and provide a complete map of respective innovation dynamics by conducting technology- and organisational-level patent analysis. As a result of the patent analysis, firms aiming at engaging in a digital transformation may be aware of the technologies that best relate to the Industry 4.0 domain and can be used for SCM-M integration. Moreover, we highlight the organisations more involved in the development of those solutions over time and offer an examination of their technological impact. In this way, firms may better identify where the technological knowledge underlying digital solutions origin and the most relevant organisations driving the digital transformation.

The rest of the paper is structured as follows. Section 2 presents the theoretical background. Section 3 shows the methodology used for this study. Section 4 offers the results of the patent analysis. Finally, Section 5 discusses main theoretical and practical implications.
2. Theoretical background
2.1 SCM-M integration
A first attempt to bridge supply- and demand-focussed processes refers to the collaborative planning, forecasting and replenishment (CPFR) practice (Fliedner, 2003), which has become well-established in the last few decades. The most important promise of CPFR is the accuracy in forecasting the demand and replenishment quantity for existing products by having the buyers and suppliers collaborating through a joint planning process based upon effective information sharing mechanisms. Thus, the ultimate aim of CPFR is to create value for supply chain members and final customers by improving overall supply chain performance, such as higher service levels, lower procurement costs, shorter cycle times, smaller inventories, reduction in forecasting errors and quicker interactions across the value chain (Attaran and Attaran, 2007; Fliedner, 2003). This discussion highlights that CPFR mainly pertains the SCM function and is devoted to building effective supply-focussed processes. On the other side, CPFR will likely fail to accomplish the specific demand-focussed processes that allow companies to manage demand shocks and select the most valuable products over time (Yao et al., 2013), which are usually in charge of the marketing function. In fact, only the marketing function provides firms with a steady scanning of customer needs and competition on the market and the adequate channelling choices for new products (Moorman and Rust, 1999). Thereby, it has been claimed that without one of the demand-focussed or supply-focussed process firms may fail to deliver customer value, hence calling for the integration of SCM and marketing functions (McKinsey & Co, 2017b; Pero and Lamberti, 2013).

Actually, the idea of a close relationship between SCM and marketing functions dates back to Porter’s (1985) value chain framework. Notwithstanding, so far, SCM and marketing functions have worked independently, and companies have only specialised in one functional area (Esper, Ellinger, Stank, Flint and Moon, 2010). As a consequence, firms more focussed on marketing processes have become particularly effective in identifying customer needs but have failed to achieve efficiency in production and distribution tasks, thus manifesting problems such as diminished service levels and stock-outs (Saldanha et al., 2013; Kulp et al., 2004; Campo et al., 2000). For instance, the main reason why some internet grocers (e.g. Webvan, Streamline, Homegrocer) initially failed is due to the fact that their marketing strategy of offering products at lower prices was not matched with a supply chain strategy that enables to respond concurrent to customer online requests while supporting a decrease in product prices (Boyer and Hult, 2005). Conversely, firms more dedicated to supply-focussed processes, such as those mainly devoted to CPFR, have found difficulties in delivering products that perfectly match the market demand despite being efficient and effective in operations and logistics activities (Pero and Lamberti, 2013; Jüttner et al., 2010). In other words, “isolation of demand and supply processes results in enduring mismatches between demand (i.e. shortages of products that customers want and/or surpluses of products that are not wanted) and supply (i.e. what is actually available in the marketplace)” (Esper, Ellinger, Stank, Flint and Moon, 2010, p. 6). According to the foregoing discussion, recent research and executives stress that companies must integrate demand-focussed activities and supply-focussed activities (e.g. Alvarado and Kotzab, 2001; McKinsey & Co, 2017b) to timely understand volatile customer demands and adjust the supply chain accordingly.

Three main activities are needed for an effective SCM-M integration: managing the integration between demand and supply processes, managing the structure between the integrated processes and customer segments, and managing the working relationships between marketing and SCM functions (Jüttner et al., 2007). These activities are complex in their nature because they ask companies to implement knowledge management procedures to leverage market information across the supply chain and, in turn, use supply-side
information to let firms efficiently deliver their products. Given the requirement of extensive collection and diffusion of market and operational information, some studies have pointed out the need of effective ways to enhance information sharing and processing between functions and throughout the supply chain (Jüttner et al., 2010). The most effective solution to this issue has been identified in the digitisation of firm processes, in line with the principles of the Industry 4.0. Notably, firms that digitise their processes will improve their capacity to acquire, analyse, and distribute market and operational knowledge by adopting cutting-edge digital technologies (cloud computing, Big Data analytics, etc.) (PwC, 2016; Ranganathan et al., 2011).

The next section discusses the origin of the idea of the fourth industrial revolution by highlighting-related enabling technologies. Furthermore, we propose a subset of them for further analysis since they may best sustain SCM-M integration.

2.2 Towards Industry 4.0: enabling technologies

The term Industry 4.0 was coined by the German association “Industrie 4.0” in 2011. The association, composed of executives, scholars, and policymakers, hinted a fourth industrial revolution based on the digitisation of firm processes (Kagermann et al., 2011). Indeed, the main idea underlying the Industry 4.0 is running businesses by adopting digital technologies that can help firms to create connections between their machinery, supply systems, production facilities, final products, and customers in order to gather and share real-time market and operational information. The German Government first supported the vision of the Industry 4.0, which was implemented into the “High-Tech Strategy 2020 for Germany” (Kagermann et al., 2013). Afterwards, several countries launched Industry 4.0 initiatives. For instance, the UK initiated the “UK CATAPULT – High Value Manufacturing”[1]. This was a strategic plan that encompasses universities and industrial players to promote the introduction of digital technologies in UK manufacturing industries. Moreover, the American “Manufacturing USA”[2], the French “Industrie du Futur”[3], and the Dutch “Smart Industry”[4] strategies provided fiscal benefits, facilitated financing and tax credits to companies aiming at devising industrial approaches compliant with the Industry 4.0 vision. More recently, the Italian Ministry of Economic Development launched the Italian plan for Industry 4.0, with the aim of increasing public and private R&D spending for digitising businesses (Calenda, 2016).

Summing up, the goal of the Industry 4.0 is to boost the digitisation and, thus, the integration of firm processes both horizontally (i.e. across functional areas) and vertically (i.e. across the entire value chain, from product development and purchasing through manufacturing, distribution and customer service). In this way, all data about operations, inbound/outbound logistics, market needs and product-customer interactions will be available real-time. As a result, digital enterprises will work together with customers and suppliers in an industrial digital ecosystem that allows them to better manage the interface between SCM and marketing functions (Ranganathan et al., 2011; Schrauf and Berttram, 2016).

Of course, many digital technologies are needed to achieve this goal, and these technologies should assure interoperability between diverse information technology (IT) systems to minimise implementation costs and time for information processing. Thus, it is necessary to clearly identify the most relevant solutions to support the transition towards the Industry 4.0. First attempts have been conducted by the Boston Consulting Group (BCG) (Rüßmann et al., 2015), PricewaterhouseCoopers (PwC) (PwC, 2016), and the Italian Ministry of Economic Development (Calenda, 2016), each of which suggested a set of enabling technologies for the Industry 4.0. Among the three classifications, there are many commonalities. The classifications by Rüßmann et al. (2015) and Calenda (2016) perfectly match in terms of naming and meaning. The classification by PwC (2016) have in common
five digital technologies with those provided by Rußmann et al. (2015) and Calenda (2016), i.e., additive manufacturing, augmented reality, cloud computing, cyber security, and big data analytics. Yet, PwC (2016) also refers to technologies for customer profiling, which can be linked to Big Data analytics solutions, according to Calenda (2016), and some specific technologies (e.g., sensors and mobile devices) that may be associated with Industrial Internet of Things (IoT) solutions, according to both Rußmann et al. (2015) and Calenda (2016). Finally, in all classifications, it emerges the need to secure information flows with cyber security technologies. Following this analysis, we identified a set of solutions that all three classifications highlight. To improve the reliability of our selection process, we also asked three academic experts in the field of digital transformation to evaluate our selection in terms of clarity, specificity and representativeness. First, the three experts were selected based on their research and consulting experience in projects involving the implementation of digital technologies in firm contexts. Each expert was asked to independently identify similarities and differences among the three mentioned classifications, as well as to propose additional technologies that may potentially be added to the classifications. The experts then met to come up with a final list of digital technologies to be shared and discussed with all the authors. By considering the experts’ feedback and advice, the final list of enabling technologies is: advanced manufacturing; additive manufacturing; augmented reality; simulation; cloud computing; industrial IoT; cyber security; and Big Data analytics and customer profiling (see Table I for more details). Despite all the eight enabling technologies defined above may be considered as relevant in the Industry 4.0 domain, the next section discusses the subset of them that is particularly important for SCM-M integration.

<table>
<thead>
<tr>
<th>Enabling technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Advanced manufacturing</td>
<td>Advanced manufacturing refers to the latest technological advancements that firms can adopt to manufacture improved firm products and/or processes. Examples of these technologies are advanced robotics, CAD, CAE, and CAM solutions, and automation solutions (Waldeck, 2014)</td>
</tr>
<tr>
<td>(ii) Additive manufacturing</td>
<td>Additive manufacturing reflects the set of technologies to develop three-dimensional objects layer by layer under computer control. The most representative technologies in this field are 3-D printings (Gibson et al., 2014)</td>
</tr>
<tr>
<td>(iii) Augmented reality</td>
<td>Augmented-reality-based systems are technological solutions currently in their infancy. They turn the environment around workers into a digital interface by placing virtual objects in the real world, with the aim of enhancing one’s current perception of reality (Kipper and Rampolla, 2012)</td>
</tr>
<tr>
<td>(iv) Simulation</td>
<td>Simulation relates to technologies that will be mostly used in plant operations to simulate production techniques, hence allowing operators to test and optimise the machine settings for the next product line before the physical changeover (Beier, 2016)</td>
</tr>
<tr>
<td>(v) Cloud computing</td>
<td>Cloud computing allows the share of IT software and hardware resources over the internet, so that information can be easily stored and accessed remotely by diverse actors (Sultan, 2013)</td>
</tr>
<tr>
<td>(vi) Industrial IoT</td>
<td>Industrial IoT refers to the use of IoT technologies in demand-focussed and supply-focussed process (Del Giudice, 2016). It favours the interoperability between devices and machines that use different protocols and have different architectures, thus allowing to have real-time data across the value-chain (Li et al., 2015)</td>
</tr>
<tr>
<td>(vii) Cyber security</td>
<td>With the increased connectivity and use of shared IT resources, the need to protect critical information grows dramatically. Thus, technologies that avoid cyber security threats, so providing secure and reliable communications, are essential (Xu, 2012)</td>
</tr>
<tr>
<td>(viii) Big Data analytics and customer profiling</td>
<td>In an Industry 4.0 context, a huge amount of data comes from many different sources, e.g., production equipment and systems, supply chain actors, and customer-management systems. Big Data analytics and customer profiling include the technological solutions that allow analysing large data sets and support real-time decision making (Chen et al., 2015)</td>
</tr>
</tbody>
</table>
2.3 Enabling technologies for SCM-M integration

As stated in Section 2.1, a critical issue for SCM-M integration is the possibility to favour and support information processing of market and operational knowledge (Jüttner et al., 2007). Thus, among the eight digital technologies defined in the previous section, only the subset of them devoted to sustaining information processing tasks is considered.

On the one hand, advanced manufacturing, additive manufacturing, augmented reality, and simulation have a focus on the digitisation of the production process, but they neither collect relevant information during the production process nor track products’ life-cycle within and beyond the factory. On the other hand, as corroborated by the information management literature and the Data–Information–Knowledge–Wisdom (DIKW) model (Rowley, 2007), Industrial IoT, cloud computing, Big Data analytics and customer profiling, and cyber security are actually devoted to running today’s businesses from an information processing point of view. This may be particularly true for SCM and marketing activities (e.g. Porter and Heppelmann, 2014; Ardolino et al., 2017). Accordingly, Industrial IoT is essential to gather and transmit raw data about products across the supply chain and product-customer interactions (McKinsey & Co, 2010; Ranganathan et al., 2011). These data can be stored in cloud solutions and constitute available information for firms (and their SCM and marketing functions). In turn, to effectively deliver customer value, information needs to be converted into relevant knowledge by employing Big Data analytics and customer profiling solutions (Ardolino et al., 2017; Jüttner et al., 2010). In this process, since data are shared on the internet, the role of cyber security is also pivotal in order to avoid the risk that information and data are stolen and misused. Therefore, we contend that Industrial IoT, cloud computing, Big Data analytics and customer profiling, and cyber security are the most relevant digital technologies for SCM-M integration.

3. Methodology

3.1 Patent analysis

We adopt patent analysis to provide a comprehensive overview of the innovation dynamics characterising the enabling technologies for SCM-M integration. With the term patent analysis, we refer to the examination of several characteristics of the technology progress and innovation activities characterising a certain industry or technology domain (Kim and Lee, 2015). For instance, Albino et al. (2014) adopted patent analysis to present the organisations and countries mainly involved in the development of low-carbon energy technologies over time. Zheng et al. (2014) examined joint-patenting activities to study international collaborations for the development of nanotechnologies, and Kim and Bae (2017) attempted to provide a novel approach to identify the most relevant wellness care solutions through patent citation analysis. Similar investigations have been made in the context of digital solutions (e.g. Chang and Fan, 2016; Ardito et al., 2017), hence highlighting the suitability of patent analysis in this specific domain.

Results of this type of analyses may lead to relevant policy and managerial implications. From a policy point of view, patent analysis has been widely used to establish public policy, as in the case of energy policies (Mueller et al., 2015). From the perspective of technology management planning, analyses of patented inventions let organisations identify innovation trends, technology leaders and followers, and whether it is beneficial to enter or continue to operate in a certain technology domain (Ernst and Omland, 2011). Eventually, patent analysis may help firms to recognise the digital technologies for SCM-M integration and better support their implementation. To complement such analyses illustrative actual examples are adopted to better comprehend the roles of the identified technologies.
3.2 Data collection
The United States Patent and Trademark Office (USPTO) is the database used to collect patents for the identified categories (i.e. Industrial IoT, cloud computing, cyber security and Big Data analytics and customer profiling). Although the USPTO only limits the protection of an invention to the US area, it is not subject to the country bias (Kim and Lee, 2015). Accordingly, several non-US patents can be retrieved. For example, in the energy conservation technology domain, Japanese organisations have filed for more patents than US ones (Albino et al., 2014). Furthermore, we did not limit the time period for patent search, so we collected all the patents registered at the USPTO that match our search criteria. The data collection procedure ended in January 2017.

The search strategy followed a keyword approach. Indeed, a well-established classification for technologies related to the Industry 4.0 does not exist. Table II presents the search terms used for patent retrieval. These come from the description provided by the BCG, PwC and the Italian Ministry of Economic Development. We searched for these terms in the description of the patent. Table II also shows the number of retrieved patents for each category at the end of the search process. After patent retrieval, we also collected all the relevant information for each patent (e.g. filing and granting years, inventors, patent owners, and citations made and received).

4. Results
This section provides a comprehensive outline of the patenting activity related to Industrial IoT, cloud computing, Big Data analytics and customer profiling, and cyber security at the technology and organisational levels. In detail, first, we carry out patent count analysis at the technology level. Patent count per year is used as the measure for the innovation efforts undertaken over time. Moreover, we provide a fine-grained investigation of how the identified technologies may support SCM-M integration by relying on examples from the managerial practice. Second, analyses at the organisational level are conducted. Accordingly, we seek to highlight the organisations more involved in the development of Industry 4.0 solutions for SCM-M integration. Specifically, we offer analyses of the most patent-intensive organisations; furthermore, we examine the extent to which those organisations are able to develop breakthrough solutions. Breakthroughs are identified by means of forward citations. Since citations rate may change over time, and older patents have more chances to be cited, we corrected for this issue by dividing the number of citations received by a patent over the average number of citations received by all patents filed for in the same year (hereafter, citation rate) (OECD, 2009; Ernst and Omland, 2011). Additionally, we examine whether organisations are involved in inter-organisational collaborations through joint patent analysis (Hagedoorn, 2003).

4.1 Technology-level analysis
Figure 1 presents temporal trends of patent development for Industrial IoT solutions. Development trends are proposed respect to the granting year. Although the filing year better reflects the period when a patent is actually developed, it may lead to biased results if

<table>
<thead>
<tr>
<th>Enabling technology</th>
<th>Search term</th>
<th>Number of patents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial IoT</td>
<td>[&quot;industrial&quot; AND (&quot;IoT&quot; or &quot;Internet of Things&quot;)]</td>
<td>335</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>[&quot;Cloud computing&quot;]</td>
<td>26,158</td>
</tr>
<tr>
<td>Cyber security</td>
<td>[&quot;Cyber security&quot; or &quot;Cyber-security&quot;]</td>
<td>501</td>
</tr>
<tr>
<td>Big Data analytics and customer profiling</td>
<td>[&quot;Big Data&quot; or &quot;Customer profiling&quot;]</td>
<td>3,047</td>
</tr>
</tbody>
</table>

Table II. Search terms and sample dimension
temporal trends are examined because the duration of the examination process usually takes three to five years, on average (Haupt et al., 2007), so more recent patents are likely to be not identified. Therefore, we analyse patent count by relying on the granting year, showing that the patenting activity trend is steadily growing (see Figure 1). Furthermore, the figures show that despite some technologies within Industrial IoT might be more mature (e.g. Radio-Frequency Identification (RFID)), the patenting activity trend starts increasing in the recent years even though we have not limited data collection to a specific period.

As per definition (Li et al., 2015), Industrial IoT includes different kinds of technologies, which can be divided into more and less mature solutions. The former type comprises QR codes (e.g. patent numbers 9,592,964, 9,754,097, and 9,849,364) (mid-1990s), RFID readers and tags (e.g. patent numbers 9,418,263, 9,405,942, 9,070,061) (early 2000s), and near field communication (NFC) solutions (e.g. patent number 9,398,531) (mid-2000s), whose development started between mid-1990s and mid-2000s. The latter type refers to the new generation of wireless sensors and actuators that have appeared in the late 2010s and are deemed to be the future of Industrial IoT (Lee and Lee, 2015), such as smart sensors and ubiquitous and in-store positioning technologies (e.g. patent numbers 9,344,963, 9,294,169, 9,264,115, 8,787,290). Although some technologies are more mature (e.g. RFID and NFC), their large-scale adoption by companies (e.g. Zara, Wal-Mart, Decathlon and Macy’s Inc.) for real-time information processing and monitoring across their SCM and marketing functions has started in the recent years. For instance, the recent Wal-Mart’s RFID strategy asked suppliers to tag forklifts, shelves and pallets, so that Wal-Mart will be able to capture data about the flow of pallets across the supply chain. Furthermore, Wal-Mart’s suppliers tagged the cases and pallets of promoted products in order to reduce information asymmetries between supply chain members, with the aim of facing the bullwhip effect in promotional periods. Nowadays, Wal-Mart also networked its suppliers for maintaining the inventory in its stores by building store-level point-of-sale/positioning systems and wireless networks; in this way, shelves are consistently stocked, and inventory is closely watched (Lu, 2014)[5]. In all cases, operational efficiency was improved, and, in turn, the marketing function of Wal-Mart was provided with elaborated data that allowed it to build a marketing strategy based on the goal of providing customers with the goods they wanted whenever and wherever they wanted them[6]. In other words, supply-focused and demand-focused processes were enabled by the data acquisition of such digital technologies to actually deliver customer value. Another approach in this sense is the use of Industrial IoT solutions on products and customers first (McKinsey & Co, 2017a), so designing the supply chain based on the data acquired from them. For example, Zipcar, a car sharing company, gathered data from advanced ubiquitous positioning technologies and smart sensors,
as well as more conventional tags and NFC solutions, that assess how cars and drivers interact. These data, after elaboration, were helpful to the marketing function to analyse and better understand how customers feel and their attitudes during the drive. Once defined a customer profile, the SCM function of Zipcar could make available to customers the cars they perceive more comfortable (McKinsey & Co, 2010). Taken together, these examples highlight how the use of IoT solutions helps companies to gather and make readily available supply- and demand-side raw data, subsequently elaborated and used to match demand and supply strategies. It is worth mentioning that in both cases more and less mature IoT technologies are adopted simultaneously. The coexistence of the two types of solutions may explain the growing patent activity trend previously discussed (Figure 1). In fact, mature, more reliable technologies are likely being improved and still contribute to the expansion of Industrial IoT in firm contexts for SCM-M integration; at the same time, novel solutions are being developed and implemented in this field.

Figure 2 presents the innovation efforts undertaken over time in the cloud computing area. Considering granted patents, we can argue that the interest in cloud computing technologies is rising, and this is likely related to the emergence of modern high-speed networks, which enable a fast access to remote data. Therefore, it is important to keep pace with their technological evolution to remain competitive in the market and adopt the latest technological advancements.

Cloud computing includes technologies enabling various types of services, such as Infrastructure as a Service (IaaS) (e.g. patent numbers 9,442,669, 9,197,543, 8,660,129), Software as a Service (SaaS) (e.g. patent numbers 9,461,996, 9,043,458, 8,700,745), Platform as a Service (PaaS) (e.g. patent numbers 9,344,487, 9,342,299, 8,850,514), and Data as a Service (DaaS) (e.g. patent numbers 9,633,090, 9,628,578, 8,850,593). These services mainly serve to structure, share, and customise remote network infrastructures (IaaS), IT platforms (PaaS), operating systems and applications of third-party organisations (SaaS), or raw data (DaaS). In sum, Cloud computing eases sharing and rapid organisation of multiple types of structured information (e.g. market and operational information) thanks to distributed IT structures that support interoperability and remote access, hence reducing the costs of implementing complex and dedicated IT systems within the company and across the supply chain (IBM, 2010). Accordingly, the migration to cloud-based solutions is rising, especially with the aim of integrating information originating from the supply chain and the market (Accenture, 2014). For instance, after that Pfizer migrated to cloud solutions, its supply chain network was able to remotely access real-time products’ information across the value chain.
and Pfizer was able to have information from portions of the world where it was not possible to trace products (e.g. Kenya) (Financial Times, 2012). Eventually, both Pfizer’s SCM and marketing functions were able to access market and operational information, and Pfizer reduced the efforts towards the integration of the functions through a cloud solution. A similar strategy was adopted by Canon, which developed the cloud platform eMaintenance® (based on patents such as 9,341,973 and 7,636,771) in order to use remote diagnostics to control over all the networked Canon devices (Ardolino et al., 2017). Indeed, by sharing information about Canon’s devices on the cloud, it was easier to provide more responsive post-sale services in the maintenance or substitution of damaged products. In other words, the post-sale service provided by the marketing function became closer to the inventory and distribution management activities of the SCM function. This discussion highlights that, differently from Industrial IoT, cloud solutions are more complex and manage multiple information flows, both inflows and outflows.

Figure 3 shows that the patenting activity trend of Big Data analytics and customer profiling recalls that of the previous enabling technologies and reflects the novelty of this technological domain, which has emerged in last few years.

The variety of technologies used in this domain is disparate since a “dominant design” (e.g. Suárez and Utterback, 1995) is far from to be reached. Industrial IoT mainly comprises systems and algorithms for targeted marketing (e.g. patent numbers 9,177,323, 9,100,214, 8,655,719, 6,925,441), systems for managing RFID, NFC and other sensor-related information (e.g. patent numbers 9,641,969, 8,933,808, 8,669,845), and more general applications for predictive analytics, data mining, text mining, forecasting, and data optimisation (e.g. patent numbers 9,639,562, 8,521,177, 8,478,702, 8,417,499). Recently, some specific initiatives have been set for helping firms to manage the SCM-M interface based on these solutions. One example is MiSCAN. It is a new marketing and supply chain analytics lab located at DeGroote’s Ron Joyce Centre and funded by the Canada Foundation for Innovation and the Ontario Research Fund. By utilising the power of Big Data analytics and customer profiling techniques, the lab combines market and operational information to generate actionable business intelligence that could not be attained without one of the two sets of information. Notably, its main goal is to derive strategic decisions integrating SCM with marketing and customer relationship management. Given this possibility, some companies are establishing functional areas devoted to analysing (big) data. So far, these areas are mainly set within the marketing function (Wedel and Kannan, 2016) but, in the future, a dedicated “analytics” function may be set to support all firms’ functions or may be integrated within the functions where
data are particularly relevant (e.g. the SCM function) (Hazen et al., 2016). Amazon and Wal-Mart are among the most active adopters of big data analytics and customer profiling solutions. They utilise those technologies to monitor, track, and secure millions of items in their inventories and rely on forecasting analytics for their “anticipatory shipping”, thus predicting when a customer will purchase a product and pre-ship it to a depot close to the final destination (Rozados and Tjahjono, 2014)[7]. Similarly, after having recognised that linking marketing promotions to increased order volumes was difficult without a clear picture and analysis of market and operational information, Sunny Delight Beverages Co. decided to adopt big data analytics to integrate and analyse marketing and supply chain information, so that the firm could finally see how decisions in marketing and SCM functions interacted and affected market demand, operational costs, and service levels[8].

Cyber security is the last category of enabling technologies we consider. Per Figure 4, the innovation efforts conducted over time for cyber security are similar to the trends of cloud computing and Industrial IoT.

As anticipated earlier, Industrial IoT and cloud computing allow generating and sharing reams of market and operational information. Yet, IoT and cloud technologies work on the internet; therefore, the data they collect and store may be stolen and misused, hence leading to important security issues in terms of competitiveness – at the organisational and supply chain level – and privacy – at the customer level (Sultan, 2013). Indeed, if any node of the supply chain is attacked, all members will be affected and may fail to attain the desired service levels. Moreover, if customers’ information is stolen, customers will not provide their data anymore, negatively influencing the possibility to design marketing campaigns and products’ orders. Both the European Commission and the USA are aware of these security issues. In fact, they provided ad-hoc directives on the design and operation of information networks, i.e., the EU Data Protection Directives 95/46, 99/5 and 2002/58 (No. 2)[9] (Weber, 2010) and the US Department of Defence Cyber Strategy. Although these solutions must be improved since the threat of cyber-attacks is growing, these directives call for methods and apparatus for identifying and detecting threats to an enterprise or e-commerce systems (e.g. patent number 9,661,025), adopting multiple computing devices to verify identity in the network (e.g. patent number 9,529,986), and developing methods to securely transfer large volumes of data between networks having different levels of network protection (e.g. patent number 9,223,991). A relevant example refers to the investments in cyber security by the UK automotive industry. That is, companies required improvements in cyber security technologies before connecting their factories and storing vast amounts of sensitive data.
about their supply chain activities and product-customer interactions in the cloud (KPMG, 2016). Thus, investments in cyber security enabled further digitisation efforts sustaining the integration between SCM and marketing functions, with the ultimate aim of better delivering customer value.

4.2 Organisational-level analysis

Tables III–VI list the most patent-intensive organisations (top 30) for each digital technology under investigation. The first column presents the name of the organisations, whereas the second, third and fourth columns reveal the related number of patents, number of breakthroughs, and share of breakthroughs over the total number of patents, respectively. According to Table III, one-third of the Industrial IoT solutions can be referred to Cisco Technology, and one-sixth of them come from Samsung Electronics’ laboratories. The rest of the patents are distributed among other several companies. It is worth mentioning that no research or governmental organisations figure in the table. This implies that neither research organisations nor governmental organisations play a key role in developing technologies in the IoT domain. Among the identified organisations, SkyBell Technologies and Cognitive Systems companies appear to be the most innovative in terms of breakthrough patents, in that they have a patent portfolio composed of 100 and 50 per cent of breakthroughs. Finally, we can conclude that collaborating is not a prevalent innovation strategy in the IoT domain since only three patents are the result of joint innovation efforts.

<table>
<thead>
<tr>
<th>Applicant</th>
<th>Patents</th>
<th>Breakthroughs</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Technology</td>
<td>130</td>
<td>7</td>
<td>5.38</td>
</tr>
<tr>
<td>Samsung Electronics</td>
<td>43</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ZTE</td>
<td>13</td>
<td>1</td>
<td>7.69</td>
</tr>
<tr>
<td>M2M and IoT Technologies</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Leeo</td>
<td>8</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>PCT</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Intel Corporation</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>LG Electronics</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SkyBell Technologies</td>
<td>5</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Cognitive Systems</td>
<td>4</td>
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<td>Convida Wireless</td>
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<tr>
<td>International Business Machine</td>
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<td>Splunk</td>
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<tr>
<td>Bastille Networks</td>
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<td>Belkin International</td>
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<tr>
<td>Digimarc Corporation</td>
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<td>General Electric</td>
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<td>Huawei Device</td>
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<td>Innovasic</td>
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<td>InterDigital Patent Holdings</td>
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<td>iRobt Corporation</td>
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<td>Motion Games</td>
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<td>National Instruments Corporation</td>
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<tr>
<td>PB</td>
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<td>RedSky Technologies</td>
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<td>SAS</td>
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<tr>
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<td>Tego</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Westvalley Digital Technologies</td>
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<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table III. Patent-intensive organisations in the domain of Industrial IoT
With regard to cloud computing, it emerges that the only private companies are included (Table IV). Among the included companies, we can consider Sprint communication, Digimarc, Red Hat, LinkedIn and Symantec as the most innovative. Indeed, these are the companies whose technology portfolios contain more breakthroughs in relative terms. In total, only 193 joint patents have been developed, with the 22 per cent of them involving a university. Although the number of joint patents is small, a huge percentage (74 per cent) presents a citation rate close or higher than the mean citation rate of the patent sample, hence suggesting that patents resulting from collaboration may have a greater impact in this field.

Table V presents patent developers for the category Big Data analytics and customer profiling. Again, only private companies have been identified. Among them, Microsoft, American Express, Intertrust Technologies and SAS are the most devoted to cutting-edge research activities, as revealed by the high share of breakthrough patents over the total number of patents they own. Table VI presents the top 30 organisations in the cyber security domain, still showing that only companies are present. Finally, in both these areas, the collaboration pattern recalls that of Industrial IoT, presenting only a few joint patents.

From Tables III–VI, it is interesting to note the cloud computing domain reflects most of the innovation efforts, probably because there is nowadays fierce competition among IT houses in developing the diverse cloud solutions. Indeed, such efforts appear to be quite distributed, with IBM as the most patent-intensive company. Instead, in the areas of data

<table>
<thead>
<tr>
<th>Applicant</th>
<th>Patents</th>
<th>Breakthroughs</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM</td>
<td>4,242</td>
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<td>0.90</td>
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<tr>
<td>Microsoft</td>
<td>1,440</td>
<td>37</td>
<td>2.57</td>
</tr>
<tr>
<td>Google</td>
<td>1,376</td>
<td>113</td>
<td>8.21</td>
</tr>
<tr>
<td>Amazon Technologies</td>
<td>1,186</td>
<td>89</td>
<td>7.5</td>
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<td>Emoire Technology Development</td>
<td>105</td>
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Table IV. Patent-intensive organisations in the domain of Cloud computing
analytics and Industrial IoT, there are some firms that own most of the patents, e.g., IBM and Cisco, which are the leaders in the respective areas (analytics and network infrastructure). Overall, IBM seems to be the firm that leads the technological development of digital technologies. This can be explained by the strategy of IBM towards the creation of integrated digital solutions, for instance by developing big data analytics solutions specifically customised for its cloud solutions[10]. However, it is also true that in terms of breakthrough technologies other companies look more effective than IBM, at least in relative terms (e.g. Microsoft). This may be related to the IBM strategy of developing technologies more focussed on its requirements and protocols, so being less attractive as the basis for future technological advancements by other organisations.

Figure 5 and Table VII dig into the innovation efforts of patent developers. Figure 5 distinguishes organisations according to the total number of patents they have developed and the number of technological classes their patents relate to, as a measure of diversification. We assigned a high level to patent intensity when an organisation owns more patents than the sample mean plus two standard deviations (SD)[11], a low level when the number of patents is below the sample mean, and a medium level in the remaining cases. Instead, we assigned a high value to diversification when an organisation has patented in three domains (no firms have patented in four domains), a medium level when it has patented in two domains, and a low level when it has patented in one domain. The first two rows of the table, thus, identify the organisations with the highest levels of diversification. These may favour integration between diverse types of
<table>
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<th>Applicant</th>
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technologies, hence reducing digitisation costs. In particular, those with a high and medium level of patent intensity can be considered as the firms that will probably lead the digitisation process, being also the developers of the majority of digital technologies (e.g. Microsoft, IBM, Cisco Technology, Intel Corporation, AT&T and Google). Instead, although less diversified and patent-intensive firms will less likely trigger interoperability between technologies and the transition towards the Industry 4.0, they may still play a key role if they focus on the development of cutting-edge digital solutions, as in the case of Sprint Communication and Intertrust Technologies (see also Tables IV and V).

Table VII further examines the organisations that applied for patents in multiple technological domains and highlight their total number of patents (column 1), the number of domains covered (column 2), and the share of patents belonging to each domain over the total number of patents (columns 3–6). The table hints that only 18 organisations have a diversified portfolio of patents with regard to the considered digital technologies. Among them, Cisco Technology, Adobe Systems, Citrix Systems, AT&T and General Electric are the most diversified, in that respective patents are more equally distributed among the diverse categories.

On the basis of Figure 5 and Table VII, we may consider the most patent-intensive and diversified firms as rivals to each other since they all have the technological resources and competencies to build comprehensive IT systems, thus competing for establishing the dominant IT network for integrating SCM and marketing functions. Instead, less-patent intensive organisations with many breakthroughs likely act as providers of cutting-edge solutions towards those big players, which will further build on them to innovate. Similarly, companies strongly focalised in one technological domain may serve as a support to big players for some specific IT applications that require a relevant knowledge of a given domain.

5. Discussion and conclusions
This paper is one of the first attempts to provide a comprehensive overview of the digital technologies supporting SCM-M integration, which has been recognised as a key success
factor to remain competitive and achieve superior financial performance (e.g. Boyer and Hult, 2005). Starting from the enabling technologies identified in the domain of Industry 4.0, first, we recognised the set of digital solutions that may better sustain the implementation of the information processing mechanisms that are required for an effective SCM-M integration (i.e. cloud computing, Industrial IoT, cyber security, Big Data analytics and customer profiling). Second, we carried out a patent analysis aimed at providing a wide-ranging outline of the technology- and organisational-level trends characterising the set of technologies under investigation, hence highlighting their innovation dynamics and in which ways they can be adopted for SCM-M integration. To do so, a novel and unique data set of patents granted at the USPTO has been collected and examined; patent data have been complemented by cases from the managerial practices.

Several interesting findings have emerged from the study. Among them, we underline that some companies (e.g. Amazon, Wal-Mart and Zipcar) already attempted to digitise their processes using the identified technologies. In particular, the proposed examples reveal the important and complementary role those technologies play for SCM-M integration. Indeed, each type of technology is especially relevant for a facet of SCM-M integration. As it mainly refers to sensors and data acquisition systems, Industrial IoT is important to collect raw data about inbound/outbound logistics across the supply chain and product-customer interactions. Cloud computing is devoted to storing raw data in structured information. Such information can be accessed by and exchanged between SCM and marketing functions, which may, in turn, use the structured information as the input for data analytics and customer profiling techniques. Finally, Big Data analytics and customer profiling extracts the knowledge that is actually important for marketing and SCM functions. Both structured information in the cloud and generated knowledge may be steadily shared with supply chain members to better match supply- and demand-focused processes. Overall, this information/knowledge flow should be protected by cyber security solutions to limit data theft. This summary provides some additional hints regarding SCM-M integration. It recalls the DIKW model, hence suggesting that SCM-M integration requires the transformation of raw data into information and information in knowledge, and this is enabled by different digital technologies (Rowley, 2007). It emerges that industrial IoT solutions are more pervasive in terms of activities, actors and types of data involved. Indeed, they are employed by distributors, retailers and products to acquire several types of data (e.g. the location of a component/product, time in production/assembly, customer data). Cloud services also manage all types of raw data, but with the aim of storing structured information that may be helpful to supply chain members and further used to extract more relevant knowledge. Therefore, the data flow underlying industrial IoT is predominantly unidirectional, flowing from the supply chain/market to the cloud. Instead, cloud services not only receive real-time data from tags and sensors, but also provide information to SCM and marketing functions, store generated knowledge, and allow supply chain members to access information in the cloud, hence managing a multidirectional flow of data/information and serving for multiple functions. Big data analytics solutions are not directly employed for managing knowledge flows. Rather, they convert information into knowledge that will be useful for a better strategic integration of SCM and marketing functions. Cyber security stands for the shield protecting information flows. Figure 6 provides a graphical systematisation of the foregoing discussion.

The examples and patent analysis also allow us to identify some of the main benefits that SCM and marketing functions may attain from each digital technology, as well as main impacts on SCM-M integration (see Table VIII). Industrial IoT, as stated, enable real-time acquisition of market and operational data, hence benefiting marketing and SCM functions, respectively. This data acquisition process does not directly affect SCM-M integration but represents its basis. Cloud computing structures data pertaining each function and allow
marketing and SCM functions to share information with each other. With regard to the SCM function, the cloud represents a repository of information that can be of use to all supply chain members, thus providing advantages in terms of interaction among members and a better understanding of each stage of the supply chain. Eventually, cloud computing
enables the possibility to steadily inspect and merge market and operational information for better managing the SCM-M interface. Data analytics and customer profiling can extract relevant knowledge from market and operational information. Such knowledge is helpful for specific activities of both marketing (e.g. customer profiling, targeted marketing, predictive analytics, improved customer relationship management) and SCM (e.g. forecasting the demand and replenishment quantity, improving service levels, lowering procurement costs and reducing inventories) functions. Moreover, data analytics conducts the data optimisation tasks that might support the concurrent planning of market- and supply-focussed activities and improve decision-making process at the company and supply chain levels. Cyber security secures all data flows.

Concerning patenting activity trends, the innovation efforts underlying all the four categories under analysis present a growing trend. This reveals the rising interest in these solutions, probably caused by the number of government initiatives aimed at digitising firm processes (e.g. Calenda, 2016; Kagermann et al., 2013). Relatedly, the organisational-level analysis shows the organisations that are technology leaders in terms of patent productivity and diversification (e.g. Microsoft, IBM, Cisco Technology), which will probably lead the digitisation process in this fourth industrial revolution. However, those organisations may still be sustained by other firms more devoted to developing cutting-edge solutions (e.g. Intertrust Technologies) or specialised in specific technological areas (e.g. Broadcom and Symantec).

So far, much has been said about why marketing and SCM functions should be integrated. However, a clear picture of the digital technologies that may be adopted to achieve this objective and their respective roles has yet to be revealed (e.g. Pero and Lamberti, 2013). Hence, this paper adds to the literature on SCM-M integration (Jüttner et al., 2007) by highlighting the enabling technologies for Industry 4.0 that may particularly serve for managing the SCM-M interface from an information processing perspective. Accordingly, we depict a comprehensive framework (Figure 6) that helps to highlight the benefits of each digital technology for SCM-M integration. Furthermore, we also contribute to this stream of literature by providing a number of information about which organisations have a leading role in their development and what the patterns of collaboration are, which may help to design firms’ digitisation process. Indeed, an integrative view of the enabling technologies favouring SCM-M integration has been loosely defined, as well as information about the available technologies in this field, their development trends, and technological impact is still scant, ultimately limiting the possibility to have a complete overview of the most relevant solutions to adopt (Deloitte, 2015; McKinsey & Co, 2015). In turn, given the absence of a clear picture of the solutions developed within the domain of Industry 4.0 either (e.g. Theorin et al., 2017), our patent analysis may also contribute to the literature examining how to foster the fourth industrial revolution from a technology point of view.

Instead, from a managerial perspective, our suggestions are twofold. First, we advise managers that it is important for firms to adopt interrelated digital solutions (e.g. Industrial IoT, cloud computing and Big Data analytics) for SCM-M integration given their complementary role from an information processing perspective. Second, and related to the first advice, it is important that, on the one hand, firms build the internal capacity to exploit the full potential of each digital technology. For instance, it is important that firms build the capabilities to design the implementation of IoT and cloud solutions across the supply chain, so that valuable market and operational data/information may be acquired and shared between SCM and marketing functions. Moreover, firms should hire data scientists that can select and analyse proper information to be turned into knowledge. On the other hand, the top management must develop a systemic view of the use of digital technologies in order to better seize the current and
future opportunities offered by the complex information flow generated by the digitisation of demand- and supply-focussed firm processes.

As with most studies, this research has some limitations that should be acknowledged. First, although the use of patent data for studying innovation dynamics is well established, some drawbacks exist. For instance, patent data may not capture some innovations because they are not patentable, or patenting is not the best protection mechanisms (OECD, 2009). Therefore, this study may be refined by including additional secondary data (e.g. publications and ongoing research and industrial projects) or primary data through interviews with industry experts and policymakers. Second, most of our attention has been devoted to the developing trends of the enabling technologies. Future research should also better analyse their implementation and usage. Relatedly, an assessment of the impact that the implementation of those technologies may have had on firm (financial and operational) performance should be further examined.

Notes
1. See https://catapult.org.uk/
2. See www.manufacturing.gov/nnmi/
4. See www.smartindustry.nl/en/
5. See also www.directionsmag.com/article/3471
6. See https://lawaspect.com/marketing-strategy-walmart/
7. See also www.marketingweek.com/2014/01/22/amazon-has-seen-the-future-of-predictability/
11. Results remain consistent if we consider the mean plus one SD.

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Financial Times (2012), "Pfizer moves supply chain to cloud”, Financial Times, 12 September, Online version, available at: www.ft.com/content/1608e5d6-fc59-11e1-ac0f-00144feabdc0


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Attraction in buyer–supplier relationships
Improving supply network performance through purchasing recognition and proficient collaboration initiatives

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Abstract
Purpose – The purpose of this paper is to shed light on the dynamics of buyer–supplier industrial relationships and the role of customer attractiveness—a requisite to obtain best efforts from suppliers involved in collaborative initiatives.

Design/methodology/approach – The paper develops a theoretical framework tested through an international survey with a structured equation modeling approach.

Findings – Results confirm that customer attractiveness positively affects both innovation and cost performance ensured by suppliers. Moreover, several direct and indirect antecedents of customer attractiveness are identified, including characteristics of the buying firm’s procurement department (i.e. procurement knowledge and procurement status) and supply chain relationship characteristics (i.e. proficiency of supplier collaboration and visibility).

Research limitations/implications – Because of the survey approach, the research results are limited to the data collected.

Practical implications – Findings support the relevance of collaborative relationships in improving performance, and the key role procurement department could play in managing the multifaceted aspects of supplier collaboration.

Originality/value – This paper investigates, on the one hand, why customer attractiveness is relevant for supply chain management, and what are the effects on innovation and cost performance ensured by suppliers; on the other hand, antecedents of customer attractiveness are considered, with a main focus on organizational and relational procurement variables.

Keywords Collaboration, Customer attractiveness, Supply chain relationships

Paper type Research paper

1. Introduction
Collaboration between buyer and supplier can offer many opportunities and, during years, literature has explored factors affecting the success of these collaborations (e.g. Anderson and Narus, 1990; Badaracco, 1991; Jap and Ganesan, 2000; Menguc et al., 2014; Schiele and Vos, 2015; Tanskanen and Aminoff, 2015; Makkonen et al., 2016), with most of these studies investigating the role of relational characteristics (e.g. length of buyer–supplier relationship, culture, trust, commitment and satisfaction, Ragatz et al., 1997). The role of these variables has been shown, although something seems missing to a complete understanding of this subject. Recently, the concept of “attraction” has been introduced to explain how relationships initiate, endure and develop (Mortensen et al., 2008; Hald et al., 2009; Kumar and Routroy, 2016; Makkonen et al., 2016; Pulles et al., 2016). Attraction is described as “the force fostering voluntarism in purchasing and marketing exchanges, and further pushing a buyer and supplier closer together in a mutual advantageous relationship” (Hald et al., 2009, p. 968).
The basic idea behind attractiveness is that high-skilled and innovative suppliers are rare, and so they may not dedicate their resources equally to all customers, thus becoming highly selective. Thereby, in order to secure access to the best resources, customers must increase their level of attractiveness (Schiele et al., 2012; Hüttinger et al., 2012; Pulles et al., 2016). Improving the level of attractiveness is also important as buyers need to achieve the status of “preferred customers” for the suppliers. As preferred customers, they have easier access to several benefits, such as product quality and innovation, better support, delivery reliability, lower price and costs (Ramsay, 2001; Hüttinger et al., 2012; Nollet et al., 2012; Pulles et al., 2016). Although the positive effects of higher attractiveness have been largely debated, a quantitative analysis of its main achievable benefits is limited (Hüttinger et al., 2012), especially in terms of performance obtained for the goods/services provided by the supplier—a relevant unit of analysis in the purchasing and supply management field—rather than at the firm level. Beyond tangible benefits, literature has also focused on how to increase customer attractiveness, through the identification of its main drivers (e.g. Hüttinger et al., 2012; Pulles et al., 2016). In this area, most studies are mainly conceptual or exploratory, whereas there is need of additional theory-testing empirical research (Spina et al., 2016).

With these premises, this study aims to investigate more in-depth the “chain of evidence” leading the buying firm to be an attractive customer. In tackling this goal, besides the typical supply chain management (SCM) perspective, the theoretical background of relationship marketing (RM) is also adopted, by including the social exchange principles to investigate the dynamics of buyer–supplier relationships. Indeed, RM recognizes that some companies are unable to fulfill the market demand with their own resources, therefore attempting to overcome this lack by establishing market-oriented business-to-business relationships (e.g. Dwyer et al., 1987; Baxter, 2012). The basic principles upon which RM is based are mutual value creation, trust and commitment (Payne et al., 1998; Hingley et al., 2015), following the idea that actions are pushed by the returns people expect to obtain (Blau, 1964).

Through an international survey, we investigate a set of possible antecedents of relationship attractiveness for customers, with a behavior-based approach (Tanskanen and Aminoff, 2015). In particular, we consider both attributes of the buyer–supplier relationship (i.e. proficiency in supplier collaboration and visibility) and characteristics of the procurement department (i.e. knowledge and status). The former is included because we expect attractiveness to increase when the buyer provides assets and capabilities that may simplify supplier’s activities (Makkonen et al., 2016). The latter is in line with the SCM literature discussing the strategic role of the procurement department, and showing how proficiency in the execution of activities increase with the status and skills of procurement employees (Yeniyurt et al., 2014). Furthermore, we explore the effect of customer attractiveness on specific purchasing category performance—i.e. innovation and efficiency. This perspective represents a novelty, as several scholars have investigated the role of customer attractiveness on procurement performance (e.g. Schiele, 2010; Wynstra et al., 2001), without adopting a category perspective.

The paper is organized as follows. First, the concept of customer attractiveness and its relevance for SCM is defined and positioned within the literature. Next, an overview of possible antecedents of customer attractiveness is presented. Through this review we are then able to describe our research framework and consequent hypotheses. Next, the research method is presented. The last three sections present data analysis, discuss results and summarize main conclusions, respectively.

2. Literature review
2.1 The concept of attraction
A general definition of the verb “to attract” is “to cause interest or pleasure and to pull someone towards you by the qualities you have, especially positive and admirable ones”
The first studies concerning attraction are related to social psychology and later social exchange literature. Social exchange deals with interdependence between social actors and focuses on the rewards and costs that individuals gain through interaction with each other (Homans, 1973; Thibaut and Kelley, 1959). A social definition of the concept of “attraction” was given by Blau (1964), who describes it as an evaluation of rewards which bring to establish a relationship: “Actor A is attracted to actor B, if A expects that association with B to be in some way rewarding for A.” This statement highlights how attraction is a force which acts to get closer two distinctive parts, whether these are individuals, groups or companies, and it underlines how the concept of value is a core element in this construct. Attraction is a fundamental element to start a relation, principally cause of desired payoff, and after the establishment, it acts to continue and strengthen the relation. In short, social exchange suggests that human factors are crucial components of attraction and that attraction plays an important role in value creation, as it influences trust and commitment between parties (Blau, 1964; Kelley and Thibaut, 1978; Thibaut and Kelley, 1959).

Extending this view to a supply chain relationship between a buying firm and its supplier, we might say that both the buyer and the supplier need to see the relationship as attractive to effectively create and transfer value (Hald et al., 2009; Pulles et al., 2016). Attraction can be also thought as an alternative approach to manage relationship based on the creation of voluntary motivation and commitment between partners, which differs from the traditional approach of managing relations by power and control mechanisms (Cox, 1999; Wagner and Bode, 2014). This view is in line with the RM perspective, according to which non-economic factors contribute to govern relationships (Schiele et al., 2015; Kim and Choi, 2015). RM considers the ability of human interactions to establish relational norms that act as governance mechanism and favor attraction. As a consequence attraction is ultimately able to support long-term relationships and to get the most from the collaborative partner, excluding, or at least limiting, opportunistic behavior (Ellis et al., 2012).

As explained by this theory, attraction can be linked to other important behavioral concepts like trust, commitment and value, which have become cornerstones in the purchasing and SCM literature. Jean et al. (2014) and Hüttinger et al. (2012), for example, argued that attraction is a prerequisite for developing trust and commitment and, as a matter of fact, the level of buyer–supplier attraction depends on disconfirmed vs confirmed expectations.

For these reasons, supply chain literature has investigated the concept of attractiveness, especially in decision-making processes. In order to select a counterpart for a specific relationship by considering the impact on choices of the counterpart (external perspective) (e.g. Olsen and Ellram, 1997), attractiveness in front of the counterpart is fundamental.

On one side, the aim is to influence the other party’s perception in order to increase the likelihood to be chosen among different alternatives, with a focus on implementing actions to “look better” (e.g. Bonner and Calantone, 2005; Tanskanen and Aminoff, 2015). The external approach is more common in the purchasing and SCM literature, being defined as a collection of critical factors pushing a company to choose a specific supply chain partner (Pulles et al., 2016; Makkonen et al., 2016). At this regard, the topic has been also investigated by several marketing researchers, as a segmentation criterion for customer portfolio analysis (e.g. Turnbull and Zolkiewski, 1997; Ritter and Andersen, 2014). According to these perspectives, customer attractiveness emerges as depending on the perception of the potential value and duration of a specific relationship.

On the other side, scholars have also emphasized the importance for buyers to “sell” their firm to critical suppliers (Krolikowski and Yuan, 2017). As a matter of fact, in the modern business context, for a buying firm it is getting increasingly important to become attractive, in order to secure satisfactory performance from suppliers (Christiansen and Maltz, 2002;
Recently, many authors point out the relevance of customer attractiveness by arguing that suppliers will not improve processes or product technologies unless attraction is present (Schiele, 2012; Tanskanen and Aminoff, 2015); in particular, attraction becomes a prerequisite for mobilizing suppliers’ resources and developing trust and commitment (Schiele, 2012).

2.2 Empirical studies on customer attractiveness antecedents

The fundamental idea of customer attractiveness is to make the supplier follows the customer’s wishes by indirectly influencing the actions of the supplier (Nollet et al., 2012).

A first stream of literature looks at the role of human factors to establish and maintain a business relationship (e.g. Ellegaard et al., 2003). This perception is consistent with socio-behavioral concepts and supports the idea that the success in influencing suppliers by being attractive is expected to depend on supplier’s perceptions. In this vein, some authors have proposed feeling and emotions as antecedents to be used in the purchasing domain to increase the understanding of buyer–supplier relationships (e.g. Jain et al., 2014), with relational elements conceived as both antecedents and consequences of attractiveness.

A second stream focuses on the relational embeddedness of buyer–supplier relationships and the effects of preferential buyer treatment (Blonska et al., 2008). Buyer’s investments to develop a supplier and some relational mediators—e.g. trust, commitment and dependency—positively influence supplier’s preferential judgment toward the buying firm. As a consequence, suppliers will more likely exploit buyer’s relational investments according to buyer’s expectation and excluding opportunistic behavior. In this vein, Schiele et al. (2011) investigated the antecedents of supplier innovativeness and supplier pricing and explained how the preferred customer status positively influences supplier innovativeness and leads to a more benevolent pricing policy by the supplier. Beyond supplier’s innovative capabilities and specialization, specific characteristics of the dyadic relationship, such as supplier development programs, have a positive effect on the supplier’s contribution to the buying firm’s innovation.

A last stream of literature focuses on buyer–supplier relationship characteristics (e.g. Hald et al., 2009), with efforts dedicated to transfer knowledge to a supplier (i.e. supplier development programs), sharing of critical information and integration of the partner in production and logistic processes. In addition, procurement department characteristics are suggested to be included in the discussion about customer attractiveness antecedents, as they affect the way the supply relationship is managed (Yeniyurt et al., 2014). As some authors suggest, procurement organizational configuration, recognition among others departments, tools implemented and procurement employees skills are strictly related to a successful management of supply relationships (Schiele et al., 2012; Bemelmans et al., 2015; Tanskanen and Aminoff, 2015; Luzzini and Ronchi, 2016).

2.3 Impact of customer attractiveness on performance

A considerable number of studies focuses on the performance effects of customer attractiveness. Hüttinger et al. (2012) provided a comprehensive literature review, discussing about the consequences of being perceived as an attractive customer, and its importance in a supply chain context. A customer perceived as attractive receives a better resource allocation and a stronger level of commitment from the supplier, which in the end also benefit relational performance. Generally speaking, most of the discussion about customer attractiveness is shaped around the benefit of expected value from the relationship (Hald et al., 2009). Ramsay and Wagner (2009), for example, explicitly stated that a supplier should devote higher attention to a customer only if the potential value to be extracted from the relationship is higher than the investment necessary to enter the relationship.
The concept of “value” has been analyzed under different lenses. Some authors have mainly investigated the economic benefits arising for the parties, defined as “social reward-cost outcomes from the relationship over time” (Halinen, 1997; La Rocca et al., 2012). Example of these are growth of purchasing volumes (e.g. Bew, 2007; Steinle and Schiele, 2008), growth of the profitability (e.g. Bew, 2007), development of additional business opportunities (e.g. Brokaw and Davisson, 1978) and reduction of the overall costs (e.g. Moody, 1992).

Other authors have looked at more qualitative aspects, such as the impact in terms of quality of the relation (Hüttinger et al., 2012). Through attractiveness, parties have interest in engaging into a new relationship or intensifying existing ones (Blau, 1964). Makkonen et al. (2016) discussed the “virtuous circle of a relationship,” where high customer attractiveness brings to a higher level of relationship development, thereby increasing its overall quality on a long-term perspective.

Finally, some scholars linked customer attractiveness to the more general literature about supply chain collaboration (e.g. Makkonen et al., 2016), presenting attractiveness as a way to engage suppliers into closer collaborations (Mortensen et al., 2008). The final outcome is a positive potential impact on innovation, production allocation, price benefits and risk reduction coming from the suppliers (Bernardes and Zsidisin, 2008; Nyaga et al., 2010).

3. Research framework and hypotheses
The different research streams previously discussed were useful to clarify the concept of customer attractiveness in industrial relationships; identify a wide set of potential antecedents for customer attractiveness, both at procurement department and supply relationship level; and focus the attention on the main impact customer attractiveness can have on performance.

So, according to this theoretical background, we were able to build a research model to be explored, as shown in Figure 1.

3.1 Effects of procurement department characteristics on the level of proficiency of supplier collaboration
Consistent with the literature about the role of procurement organizational configuration and recognition among others departments for successful relationship management (Bemelmans et al., 2015; Tanskanen and Aminoff, 2015; Luzzini and Ronchi, 2016), we consider two main antecedents of customer attractiveness.

First, in line with Cohen and Levinthal’s (1990) discussion around absorptive capacity, a well-formed intra-unit communication network and a good communication climate and culture lead to improve employees’ ability to learn and consequently to an effective implementation of new ideas. In addition, an internal “climate of openness” (Nevis et al., 1995) is one of the most important factors facilitating organizational learning (Saenz et al., 2014), fostering the growth of an adequate level of employees’ knowledge and skills which, in turn, contribute to empower a department within the organization (e.g. Rothstein et al., 1995). Especially important is the development of technical competence of procurement professionals in order to get the most from interactions with technical personnel in team decision-making processes and increase purchasing recognition from others functions (Kauppi et al., 2013; Caniato et al., 2010). Therefore the level of skills, together with the ability to access critical information and share information with other departments,
represents a determinant of procurement status and recognition within the organization (Pearson et al., 1996; Hesping and Schiele, 2015). Based on these considerations, the following hypothesis is formulated:

**H1.** A higher procurement knowledge positively influences procurement status.

Second, authors have discussed the relevance of procurement status for a strategic recognition. Burt and Soukup (1985) discussed the link between purchasing recognition and responsibilities assigned for new product development (NPD) activities, while Hillebrand and Biemans (2004), Tracey (2004) and Thomas (2013) concluded that suppliers are more likely to collaborate and to be involved at early stages of NPD when procurement contributions are recognized by the top managers. Similarly, Schiele (2010) linked the possibility to involve supplier and procurement in proficient collaboration programs (such as early supplier involvement, supplier development and supplier integration), addressing that how companies organize their purchasing process influences the proficiency of collaborations between suppliers and customers. Based on these considerations, the following hypothesis is formulated:

**H2.** A higher procurement status positively influences the level of proficiency of supplier collaboration.

### 3.2 Effects of supply relationships characteristics on relationship attractiveness

Consistent with RM and SCM literature insights, suppliers are more likely attracted by buyers willing to involve supply chain partners in strategic decisions.

On the one hand, relational-specific investments reflect a commitment and long-term orientation (Schiele and Vos, 2015). In particular, we expect that the more customers invest in the relationship, the more customer attractiveness increases (Hald et al., 2009; Schiele, 2012). In this vein, Vollmann and Cordon (2002) also argued that “what makes customer attractive to a supplier – over the long run – is learning.” According to this perspective, the proficiency of implementing supplier development programs and/or its integration in order fulfillment and/or supplier involvement in NPD represent opportunities for a supplier to increase its own knowledge (Nagati and Rebolledo, 2013), thus making the relationship with a customer “more attractive.” Based on these considerations, the following hypothesis is formulated:

**H3.** A higher level of proficiency of supplier collaboration positively influences supplier’s perception of relationship attractiveness with the customer.

On the other hand, visibility plays an important role in successful supply chain relationship (Wilson, 1995; Baxter, 2012). The relationship between visibility, trust and attraction in supply chain relationships emerges as a closed loop in the literature. Attraction might potentially generate trust and commitment (Dwyer et al., 1987; Ellegaard, 2012), while trust and visibility are fundamental conditions to increase attraction (Hald et al., 2009). The level of visibility (i.e. sharing of meaningful supply chain data, such as inventory level or forecasts) positively influences the value of the relationship perceived by the supplier (Walter and Ritter, 2003; Jain et al., 2014), which is a major driver of attraction (Hald et al., 2009; Pulles et al., 2016). Based on these considerations, the following hypothesis is formulated:

**H4.** A higher level of visibility positively influences supplier’s perception of relationship attractiveness with the customer.

### 3.3 Effects of relationship attractiveness on category performance

The benefits of relationship attractiveness on several performances are discussed in literature (e.g. Nollet et al., 2012; Bengtsson et al., 2013). A relationship is more attractive if
either technological collaborations or operational collaborations are in place between the supplier and the customer. First, customer attractiveness is expected to lead suppliers to improve processes and technologies, which can be exploited according to customer’s wishes (Johnsen, 2009; Ellegaard, 2012). Second, relationship attractiveness has a positive effect on the innovation contribution of the supplier in a buyer–supplier relationship (Schiele et al., 2011; Luzzini et al., 2015). However, we also assume that a stronger innovation effort is not compromising cost performance ensured by suppliers. Indeed, the attracted supplier will reserve a more benevolent pricing method and will constantly be interested in aligning its own wishes with the buyer’s (Christiansen and Maltz, 2002; Schiele et al., 2011; Bemelmans et al., 2015). This perspective is consistent with the diffused idea that attractiveness is pursued first to give economic benefits for the parties (La Rocca et al., 2012), but also with RM, which addresses the importance of interpersonal factors beyond economic drivers to improve performance (Schiele et al., 2015; Kim and Choi, 2015). Based on these considerations, the following hypotheses are formulated:

**H5.** A higher level of relationship (customer) attractiveness positively influences the category innovation performance ensured by the supplier.

**H6.** A higher level of relationship (customer) attractiveness positively influences the category cost performance ensured by the supplier.

The overall research framework is reported in Figure 2.

4. Methodology

4.1 Sample

To investigate our research questions, we use the data collected by the International Purchasing Survey (Knoppen et al., 2015). Using purchasing categories as unit of analysis, the survey aims to investigate how companies define their procurement strategies, what their procurement skills and capabilities are, how the procurement activities are conducted and what effect the procurement activities exert on procurement and firm performance.

Data were collected during the 2010–2011 period in different countries through a multi-language web platform; the survey was originally designed in English and subsequently translated according to a standard procedure (TRAPD, Harkness et al., 2010). Before administering the survey, the questionnaire was tested in several countries with procurement professionals to check the clarity of the questions. The respondents consisted of highly qualified procurement professionals who had played important roles in the procurement functions of their firms. These individuals were selected by collaborating with the procurement professionals’ national associations, which had provided the lists of their members who had been personally contacted by the local research group. After the data...
collection process, each country cleaned its own data in accordance with a common agreement to build a shared international database.

The total sample contains 681 companies from ten countries. However, only a subset of them provided sufficient information to test the hypotheses stated above, as we were forced to exclude firms not performing at all supplier collaboration (i.e. supplier involvement into NPD, supplier integration and supplier development), necessary to test the model. As a result, the sample considered includes 524 firms (Table I) from ten countries and mostly from the manufacturing sector. The targeted companies vary in size and are mostly from the

<table>
<thead>
<tr>
<th>Country</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>46</td>
<td>8.8</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>39</td>
<td>7.4</td>
</tr>
<tr>
<td>UK</td>
<td>66</td>
<td>12.6</td>
</tr>
<tr>
<td>Germany</td>
<td>48</td>
<td>9.2</td>
</tr>
<tr>
<td>Spain</td>
<td>44</td>
<td>8.4</td>
</tr>
<tr>
<td>Sweden</td>
<td>115</td>
<td>21.9</td>
</tr>
<tr>
<td>Finland</td>
<td>30</td>
<td>5.7</td>
</tr>
<tr>
<td>United States</td>
<td>59</td>
<td>11.3</td>
</tr>
<tr>
<td>Canada</td>
<td>43</td>
<td>8.2</td>
</tr>
<tr>
<td>France</td>
<td>34</td>
<td>6.5</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Sales (m €)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td>91</td>
<td>17.4</td>
</tr>
<tr>
<td>&lt;100</td>
<td>60</td>
<td>11.5</td>
</tr>
<tr>
<td>&lt;200</td>
<td>56</td>
<td>10.7</td>
</tr>
<tr>
<td>&lt;500</td>
<td>92</td>
<td>17.6</td>
</tr>
<tr>
<td>&lt;1,000</td>
<td>65</td>
<td>12.4</td>
</tr>
<tr>
<td>≥1,000</td>
<td>120</td>
<td>22.9</td>
</tr>
<tr>
<td>Missing</td>
<td>40</td>
<td>7.6</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Sector</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>343</td>
<td>65.5</td>
</tr>
<tr>
<td>Transportation, storage and communication</td>
<td>29</td>
<td>5.5</td>
</tr>
<tr>
<td>Wholesale and retail trade</td>
<td>28</td>
<td>5.3</td>
</tr>
<tr>
<td>Other</td>
<td>26</td>
<td>5.0</td>
</tr>
<tr>
<td>Construction</td>
<td>23</td>
<td>4.4</td>
</tr>
<tr>
<td>Electricity, gas and water supply</td>
<td>13</td>
<td>2.5</td>
</tr>
<tr>
<td>Professional and administrative services</td>
<td>13</td>
<td>2.5</td>
</tr>
<tr>
<td>Human health and social work activities</td>
<td>10</td>
<td>1.9</td>
</tr>
<tr>
<td>Financial services</td>
<td>9</td>
<td>1.7</td>
</tr>
<tr>
<td>Public administration and defense</td>
<td>8</td>
<td>1.5</td>
</tr>
<tr>
<td>Agriculture, forestry, fishing and mining</td>
<td>7</td>
<td>1.3</td>
</tr>
<tr>
<td>Hotels and restaurants</td>
<td>5</td>
<td>1.0</td>
</tr>
<tr>
<td>Arts, entertainment and recreation</td>
<td>4</td>
<td>0.8</td>
</tr>
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<td>Missing</td>
<td>6</td>
<td>1.1</td>
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</table>

<table>
<thead>
<tr>
<th>Respondent position</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPO, VP of procurement</td>
<td>70</td>
<td>13.4</td>
</tr>
<tr>
<td>Procurement director</td>
<td>115</td>
<td>21.9</td>
</tr>
<tr>
<td>Procurement manager</td>
<td>238</td>
<td>45.4</td>
</tr>
<tr>
<td>Senior, project buyer</td>
<td>44</td>
<td>8.4</td>
</tr>
<tr>
<td>Buyer, procurement agent</td>
<td>28</td>
<td>5.3</td>
</tr>
<tr>
<td>Other</td>
<td>28</td>
<td>5.3</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Table I. Sample descriptives Total 524 100
manufacturing sector, although other industries are represented as well. Non-respondent bias was tested for by identifying the differences between the first wave of respondents, and the later waves (the ANOVA shows no significant differences in terms of company size and sectors distribution). The average response rate was 10 percent.

4.2 Measure
The seven constructs included in our model are described in Table II, in light of extant literature. More specifically, for what concerns identification and selection of antecedents, we followed the approach suggested by Tanskanen and Aminoff (2015), considering both resource-based antecedents with a main focus on procurement (i.e. management and competences) and behavior-based antecedents with a main focus on relational choices. For the former approach, we included “procurement status” and “procurement knowledge”; for the latter, the level of “proficiency of supplier collaboration” (i.e. ability to implement effectively collaboration initiatives with suppliers) and the level of “visibility” between supply chain actors.

About the measure of customer attractiveness, we adopted a business-related approach, consistent with Ellegaard et al. (2003), considering attractiveness as linked to concrete and fact-based measures. In particular, in the context of industrial relationships, intensity of linkage between supply chain actors is hardly driven by how the relationship is perceived as strategic (Park et al., 2010); for this reason, we approximate the concept of “customer attractiveness” with that of “Relationship attractiveness,” thus including items measuring how much the buyer has invested in the relationship with the supplier, e.g. by implementing different levels of collaboration (technological and operational; Ragatz et al., 1997). The idea is that the more the customer tends to build collaborative relationships within the supply network, the more it will be perceived as a strategic firm, thus increasing is attractiveness (Nyaga et al., 2010).

Finally, “cost performance” and “innovation performance” reflect the traditional dimension to measure purchasing efficiency (i.e. internal and external) and supplier

<table>
<thead>
<tr>
<th>First-order construct</th>
<th>Description</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement knowledge</td>
<td>The procurement managers’ technical and managerial knowledge</td>
<td>Carter and Narasimhan (1996), Tu et al. (2006), Zheng et al. (2007), Bals et al. (2009)</td>
</tr>
<tr>
<td>Procurement status</td>
<td>The actual and formal recognition of the procurement department strategic role within the buying firm</td>
<td>Pearson et al. (1996), Carr and Smeltzer (1997), Mol (2003), Cousins et al. (2006), González-Benito (2007)</td>
</tr>
<tr>
<td>Proficiency of supplier collaboration</td>
<td>The experience of the buying company in managing collaborative relationships with suppliers</td>
<td>Sheu et al. (2006), Oh and Rhee (2008), Melander and Lakemond (2015)</td>
</tr>
<tr>
<td>Visibility</td>
<td>A willingness to rely on a supply chain partner in whom one has confidence, by sharing strategic information</td>
<td>Francis (2008), Hald et al. (2009)</td>
</tr>
<tr>
<td>Relationship attractiveness</td>
<td>The extent to which the customers make suppliers participate to critical collaboration projects, such as new product development, supplier development and supplier integration in the operations processes</td>
<td>Ragatz et al. (1997), Narasimhan and Das (2001), Yan and Dooley (2014), Lawson et al. (2015)</td>
</tr>
<tr>
<td>Innovation performance</td>
<td>The extent to which the customer get innovation from suppliers of the given category</td>
<td>Lagace (2003), Luzzini et al. (2015)</td>
</tr>
<tr>
<td>Cost performance</td>
<td>The extent to which the customers get cost reduction performance from suppliers of the given category</td>
<td>Hartley et al. (1997), Hartmann et al. (2012)</td>
</tr>
</tbody>
</table>

Table II. Measures
contribution to innovation (i.e. product/service innovation and variety) at the category level; both measurements follow conceptualizations proposed in the past (e.g. Schiele et al., 2011; Caniato et al., 2014).

As previously explained, for the purpose of our analysis, we intend the concept of customer attractiveness as “the customer’s characteristics which lead supplier’s effort to establish and develop a relationship with a buying firm” (Pulles et al., 2016). Therefore, we relate such concept to the customer’s relationship collaboration choices, thus assessing the construct through “the extent to which the buying firm involves supplier earlier when developing new products”; “the extent to which the buying firm implements supplier development programs within the supply network”; “the extent to which the buying firm integrates suppliers in production and order fulfillment activities.”

5. Data analysis

In order to analyze 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 (MacKenzie and Podsakoff, 2012). Regarding the survey, the research project was labelled as a comprehensive overview of procurement strategies and practices, therefore no explicit reference to customer attractiveness or its effect on innovation performance was evident. Thus, respondents’ attention was not drawn to the relationships being targeted in this study. Moreover, questions were organized in an order that separated category characteristics from strategies and practices as well as from performance to prevent respondents from developing their own theories about possible cause–effect relationships. Furthermore, the questionnaire was carefully created and pretested and respondents were assured of strict confidentiality. As a second mean to ensure against common method bias, we performed the common latent factor technique (MacKenzie and Podsakoff, 2012); with this analysis, we found that the common latent variable has a linear estimate of 0.5728. This value, when squared, indicates a variance of 0.328 which is below the threshold of 0.50. Overall, this ensures data analysis is not excessively affected by common method bias.

The presented hypotheses were tested using covariance-based structural equation modeling (CB–SEM), which is a common method employed for this type of research, together with partial least square structural equation modeling (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 (Hair et al., 2011), as ML compared to other methods (such as 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 data set according to the Doornik–Hansen test ($\chi^2 = 1,667.317; p > \chi^2 = 0.000$).

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 analyzed and interpreted sequentially in two stages: first, the assessment of the reliability and validity of the measurement model and second, the assessment of the structural model (Anderson and Gerbing, 1988). 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.
6. Results

6.1 Measurement model

Table III shows the results of confirmatory factor analysis. All of the model fit indicators were found to be satisfactory ($\chi^2 = 176.649; \chi^2/df = 1.344; CFI = 0.989; TLI = 0.985; RMSEA = 0.026; CD = 0.998$). The factors reliability, as measured by the Cronbach’s $\alpha$ and composite reliability (Fornell and Larcker, 1981), was fully satisfactory (Nunnally and Bernstein, 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 47 and 69 percent. As an additional test for discriminant validity, we compared the squared correlation (Table V) between two latent constructs to their AVE estimates (Fornell and Larcker, 1981). According to this test, the AVE for each construct should be higher than the squared correlation between each pair of constructs. This condition is valid for all the constructs (Tables III and IV).

6.2 Structural model

The postulated path model produced a sufficient fit to the data ($\chi^2 = 314.965; \chi^2/df = 2.151; RMSEA = 0.045; CFI = 0.961; TLI = 0.951; SRMR = 0.840; CD = 0.987$). Table V and Figure 3 shows the results of the hypotheses testing. All the standardized effects are positive and highly significant.

<table>
<thead>
<tr>
<th>First-order construct</th>
<th>Indicators</th>
<th>Loading</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement status</td>
<td>Top management is supportive of efforts to improve the procurement department</td>
<td>0.734</td>
<td>0.850</td>
<td>0.656</td>
</tr>
<tr>
<td></td>
<td>Procurement’ s views are considered important by most top managers</td>
<td>0.884</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Procurement is recognized as an equal partner with other functions of the top management team</td>
<td>0.805</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement knowledge</td>
<td>The knowledge of procurement manager(s) when making business decisions</td>
<td>0.880</td>
<td>0.900</td>
<td>0.695</td>
</tr>
<tr>
<td></td>
<td>The knowledge of procurement manager(s) when dealing with new technologies</td>
<td>0.832</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The knowledge of procurement manager(s) when managing daily operations</td>
<td>0.823</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The knowledge of procurement manager(s) when dealing with human issues</td>
<td>0.797</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proficiency of supplier collaboration</td>
<td>Proficiency of supplier development</td>
<td>0.809</td>
<td>0.870</td>
<td>0.692</td>
</tr>
<tr>
<td>Visiblity</td>
<td>Share inventory level knowledge with suppliers</td>
<td>0.811</td>
<td>0.708</td>
<td>0.634</td>
</tr>
<tr>
<td></td>
<td>Share production planning and/or demand forecast information with suppliers</td>
<td>0.818</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship attractiveness</td>
<td>Intensity of technological collaboration (supplier involvement in NPD)</td>
<td>0.760</td>
<td>0.781</td>
<td>0.544</td>
</tr>
<tr>
<td></td>
<td>Intensity of operational collaboration (supplier integration)</td>
<td>0.705</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intensity of supplier development</td>
<td>0.745</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category cost performance</td>
<td>The procurement price</td>
<td>0.648</td>
<td>0.640</td>
<td>0.471</td>
</tr>
<tr>
<td></td>
<td>The cost of managing the procurement process</td>
<td>0.723</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category innovation performance</td>
<td>The supplier time-to-market for new or improved product/services</td>
<td>0.707</td>
<td>0.654</td>
<td>0.489</td>
</tr>
<tr>
<td></td>
<td>The level of innovation in products/service from suppliers</td>
<td>0.687</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table III. Resulting measurement model
Also, others approach to test the data were used (i.e. PLS), but using the AIC and BIC criterion, the CB–SEM using the ML estimation reveals to be the best (AIC: 28.443; BIC: 28.711).

7. Discussion
After our testing, all the formulated hypotheses have been confirmed. We are able to demonstrate that relationship attractiveness positively affects the customer performance related to a given procurement category, in terms of both innovation and cost. This result is in line with previous studies about supplier collaboration (e.g. Corsten and Felde, 2005; Vereecke and Muylle, 2006), and becomes interesting in the context of our discussion, as it links the ways to become more attractive customers (which is a typical marketing

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Procurement knowledge</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Procurement status</td>
<td>0.124*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Proficiency of supplier collaboration</td>
<td>0.106**</td>
<td>0.049**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Visibility</td>
<td>0.002</td>
<td>0.008</td>
<td>−0.163</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Relationship attractiveness</td>
<td>0.067*</td>
<td>0.0225*</td>
<td>0.043</td>
<td>0.106**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Innovation performance</td>
<td>0.001</td>
<td>0.004</td>
<td>−0.062</td>
<td>−0.037</td>
<td>0.025*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7. Cost performance</td>
<td>0.001</td>
<td>0.013*</td>
<td>−0.043</td>
<td>−0.068</td>
<td>0.046**</td>
<td>0.032*</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table IV.**
Correlation matrix
Notes: *p < 0.5; **p < 0.01; ***p < 0.001

<table>
<thead>
<tr>
<th>Parameter estimates</th>
<th>SE</th>
<th>Z</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement knowledge → Procurement status</td>
<td>0.312***</td>
<td>0.045</td>
<td>6.93</td>
</tr>
<tr>
<td>Procurement status → Proficiency of collaboration</td>
<td>0.249***</td>
<td>0.047</td>
<td>5.26</td>
</tr>
<tr>
<td>Proficiency of collaboration → Relationship attractiveness</td>
<td>0.305***</td>
<td>0.053</td>
<td>6.00</td>
</tr>
<tr>
<td>Visibility → Relationship attractiveness</td>
<td>0.319***</td>
<td>0.050</td>
<td>5.96</td>
</tr>
<tr>
<td>Relationship attractiveness → Category Innovation performance</td>
<td>0.284***</td>
<td>0.057</td>
<td>3.85</td>
</tr>
<tr>
<td>Relationship attractiveness → Category Cost performance</td>
<td>0.239***</td>
<td>0.062</td>
<td>4.92</td>
</tr>
</tbody>
</table>

**Table V.**
Parameters estimate
Notes: *p < 0.5; **p < 0.01; ***p < 0.001 (two tailed test)

**Figure 3.**
Resulting structural model
Notes: Model fit: $\chi^2=314.965$; $\chi^2/df=2.151$; RMSEA=0.045; CFI=0.961; TLI=0.951; SRMR=0.840; CD=0.987. *p<0.5; **p<0.01; ***p<0.001
perspective; Hesping and Schiele, 2015) to the effects that this may have on performance at specific functional level (purchasing, in this case).

On the one hand, we show that customer attractiveness depends not only on marketing and economic aspects (such as brand and reputation, market success, economic and financial performance) but also on supply chain aspects—such as the way customers shape collaborations with other supply chain actors. On the other hand, we empirically test how customer attractiveness might provide benefits for companies, demonstrating that being an attractive customer gives the possibility to attract best-in-class suppliers, which in turn ensure better innovation and cost outcomes (e.g. Kim and Choi, 2015). We can therefore conclude that customer attractiveness seems to produce win–win outcomes for the dyad, as the supply network can benefit from long-term and strategic relationships, which are assurance of stability and able to generate more commitment, while the buying firm is able to leverage on its suppliers’ technological skills in order to innovate, without neglecting procurement prices or being afraid of non-benevolent pricing policies in the long run (Baxter, 2012). This also adds some more insights about the debated supply chain cost-innovation trade-off: investing in collaborative relationships makes a firm more attractive, with the change of not only securing suppliers that are capable to launch new/better products and services on the market, but also to increase process efficiency (Carr and Pearson, 2002; Lawson et al., 2015).

Besides these main results, we were able to determine two direct antecedents of customer attractiveness, related to the way the buyer–supplier relation is managed: the level of proficiency in managing supplier collaboration; and the level of visibility with the suppliers. This result is aligned with previous studies focused on industrial relationships (e.g. Hüttinger et al., 2012; Wong et al., 2013) that (directly or indirectly) consider the ability to manage relationships and the ability to establish a trustful environment between the parts as powerful tools for improving the customer attractiveness of the focal company. Our results confirm that the higher the level of visibility between supplier and customer, the more the customer appears as a trustful partner in the eyes of the supplier, thus being likely to become attractive (Caridi et al., 2014). This finding also supports industrial marketing studies, linking attractiveness to the level of openness and trust demonstrated by the actors involved (Tanskanen and Aminoff, 2015).

As for the other antecedent, the proficiency in managing collaborative relationships involves both the way procurement activities are executed, as well as the strategic orientation of the department. Past literature is not only rich in presenting the value of collaboration between buyer and supplier at different levels (e.g. Yan and Nair, 2016; Luzzini et al., 2015), but also in promoting the need of a learning curve of collaboration initiatives, in order to obtain the maximum benefit (Zacharia et al., 2009; Yan and Dooley, 2014).

In order to create the prerequisites for customer attractiveness, two further variables are identified as relevant—which both relate to the characteristics of the procurement department. As a matter of fact, we are able to show that with the increase of procurement people skills and capabilities, the status of the procurement department within the firm (i.e. the formal recognition by other departments) is likely to increase (Luzzini and Ronchi, 2016). This, in turn, increases the confidence in implementing more strategic relationship with suppliers (Mortensen and Arlbjørn, 2012). With procurement being the primary interface with the supply network, its formal recognition in the buyer organization might pave the way to increased collaborative initiatives within the supply network. This represents a key insight for companies that sometimes neglect the pivotal role of procurement for value creation and the achievement of better supply chain performance. This finding shed some new light on the literature about organizational choices in procurement and company performance, by illustrating a new important benefit achieved through the adoption of a
strategic procurement department—i.e. the increase of attractiveness (Zheng et al., 2007). Finally, identification of procurement department characteristics as indirect antecedents to customer attractiveness is a novel contribution to literature, relevant also to extend the current debate about boundaries between purchasing and organization design literature (Adobor and McMullen, 2014).

8. Conclusions

This paper aims to investigate the impact of customer attractiveness on performance (innovation and cost) and assess the impact of antecedents on customer attractiveness. The main results identified are the following:

(1) Customer attractiveness—interpreted as “relationship attractiveness”—is proposed as a key element to foster industrial relationships, and obtain better performance (cost and innovation) from the supply network.

(2) Two important antecedents of customer attractiveness are identified: the level of proficiency in managing collaborative relationships and the level of visibility set within the buyer–supplier relationship.

(3) Procurement organizational aspects are relevant variables to be considered to enhance customer attractiveness, as both procurement status and procurement people knowledge determines the ability of the buying company to implement (and successfully manage) collaborative relationships.

8.1 Contribution for research

This work interprets the construct of customer attractiveness on a different perspective from the past (using the concept of “relationship” attractiveness), but still promoting attractiveness as a key variable to manage buyer–supplier relationship, in line with past studies (e.g. Schiele et al., 2011; La Rocca et al., 2012). This indirect approach has the disadvantage of not directly assessing suppliers’ perception by explicitly asking about the level of customer attractiveness, but has the advantage to avoid social desirability biases that might come in place when asking buyers and suppliers about the quality of their relationship. The final results are a “untraditional” measurement of the level of customer attractiveness, but also unbiased and fair (as not being evident to the respondent). Furthermore, we were also able to show that customer attractiveness is not only related to innovation performance but also positively affects costs offered by suppliers to buyers (Hartley et al., 1997), and these benefits are achieved at the procurement category level. This result is quite new, as most of previous studies mainly focus on company performance—with more attention to economic rather than to operational results (e.g. Pulles et al., 2016).

A third contribution of the study is the identification of main antecedents of customer attractiveness, both direct and indirect. The study proposes direct antecedents related to the characteristic of the supply relationship the buying firm put in place (collaboration and visibility offered in the relationship), whereas indirect antecedents reflect procurement department status and competences. This is a key contribution for research, as it extends past research on the topic, mainly focused on “soft” aspects and/or marketing choices (e.g. Hüttinger et al., 2012), without considering indirect impacts or providing a clear path to the achievement of customer attractiveness.

8.2 Contribution for practice and further development

Study results are also relevant from a managerial perspective. These findings suggest to procurement managers that one of the key supplier management decision variable—configuration of the nature of the relationship—is a key driver of company
attraction. This means that managers should push for investing in collaborative and long-term collaboration, if they want to conquer the attention of potential valuable supply chain partners; for this investment, they will be repaid with higher innovation outcome and cost improvements resulting from the buyer–supplier relationship. However, this lever should be activated only if certain pre-conditions exists—the willingness to manage collaborative relationship and to share information within the supply chain. When these factors are not present, pushing collaborative initiatives can result in a failure project, and even reducing the overall customer attractiveness.

In this, managers should also consider that knowledge and competences of procurement people are key variables to increase the procurement status, which have an impact on customer attractiveness as well. The perceived and real importance of a procurement department is higher when procurement managers have an in depth knowledge in taking business decisions, managing new technologies and dealing with human issues.

Further research could be identified as well. Investigation on either specific industry or specific countries could be performed to address whether significant differences would appear in different areas of investigation. This can be definitely something that must be explored in a future study on the subject, through a qualitative data collection approach (e.g. case studies), to complement the reliability of research findings. Finally, further research is also necessary to deepen the relationship between buyers’ performance and customer attractiveness: the current model includes only innovation performance and cost performance, but further dimensions can be considered as well (e.g. flexibility and process quality).

References


Further reading


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Supply chain – marketing integration

How do European SMEs go to China via the New Silk Road

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Universitetet i Agder, Kristiansand, Norway, and
Shan Chen and Marco Mandolfo
School of Management, Politecnico di Milano, Milano, Italy

Abstract

Purpose – The purpose of this paper is to discuss China’s New Silk Road initiative as an opportunity for European small and medium-sized enterprises (SMEs) to export to Chinese market. It offers research propositions on redefining the business process of European SMEs and Chinese importers in light of the initiative.

Design/methodology/approach – SMEs’ export barriers, particularly in SCM and marketing, are identified through literature review. Then they are discussed in accordance with the measures that New Silk Road proposed.

Findings – Logistic infrastructure development under the New Silk Road significantly lowers the supply chain barrier. Marketing remains a challenge for European SMEs to export to China. This paper argues that the European SMEs and the Chinese importers should create closer collaboration, expand their relationship beyond SCM, and integrate their marketing efforts for mutual benefits.

Research limitations/implications – Several future research areas are proposed in this paper. The authors invite researchers and practitioners to deepen the discussion with empirical evidence.

Practical implications – The New Silk Road has already become a high stake project for many countries involved. Many measures are yet to be defined and the stakeholders, including industries and businesses, should have an influence on their definition. This paper provides the authors’ viewpoints on how businesses should act in this initiative.

Originality/value – Despite being an important topic of the world’s economy in the recent years, the New Silk Road initiative has rarely been studied in management research, possibly due to lack of evidence. As its development significantly sped up since 2017, it is high time that the research community starts to contribute to the knowledge building in this project. This paper is among the firsts to call for and to propose avenues for future research efforts.

Keywords Marketing, SMEs, Supply chain management, New Silk Road

Paper type Viewpoint

In 2013, China has announced the double trade corridor, reviving the ancient trade route the Silk Road that connected China and the West: Central Asia, the Middle East and Europe. The “Belt and Road Initiative” was officially released in 2015, in which a $900bn infrastructure scheme involving 68 countries was proposed. One of the main aims is to boost global trade (Bruce-Lockhart, 2017). On the other end of the New Silk Road, it presents strategic importance for Europe. Europe has the chance to further leverage its status as one of China’s most important trade partners to engage profitably with Chinese and local companies. Europe could also use it to pave the way for new trade opportunities for its many small businesses in the increasingly difficult yet important Chinese market (Loesekrug-Pietri, 2015). In 2015, the Dutch city Rotterdam welcomed its first containers by rail from China. The route shortens the transportation time from around 60 days by sea to about 14 days by land (Lehmacher, 2015). By 2017, there have been more than 6,000 trips between 35 Chinese cities and 34 European cities; there are 57 routes and more than 3,000 annual trips planned and counting (Gu, 2017).
China’s exports are traditionally stronger than those of most of its trading partners (Lehmacher, 2015). The New Silk Road initiative intends not only to support China’s export, but also to stimulate China’s import in order to satisfy Chinese consumers’ increasing appetite for high quality European products, and to improve the capabilities of Chinese enterprises through deepened collaboration. Besides the high-end consumer goods and industrial goods from Europe, which are already the main force of Europe’s export, the initiative also seeks to largely expand the trading categories and to democratize the consumption of imported goods (China Daily, 2015). This brings a unique opportunity for Europe’s small and medium-sized enterprises (SME), which make up over 99 percent of all enterprises in EU and contribute 57 percent of value added in EU. Large enterprises are traditionally more international than SMEs as it is costly to reach foreign markets (Airaksinen et al., 2015). The New Silk Road initiative also encompasses a number of measures to lower trade barriers and to reduce trade costs, creating favorable conditions for European SMEs to take part in the trade.

Nonetheless, the New Silk Road has high stakes and high impacts on entire value chains. Besides policy-makers and the related industries, the New Silk Road initiative also creates vast avenues for potentially impactful research. In particular, supply chain management (SCM) and marketing are two important areas of barriers to SMEs export. Meanwhile, the New Silk Road initiative’s infrastructure development especially emphasizes supply chain facilities and eventual marketing supports. Due to the novelty of such an initiative, new services and new business models are to be elaborated and tested in order to ensure the value realization (Lehmacher, 2015). SCM and marketing play important roles in this process; however, the knowledge directly applicable to this context rarely exists. Therefore, in this paper, we first discuss the implication of New Silk Road for European SMEs, building on the literature of SME export and current operations under the New Silk Road initiative; then, we propose future research areas of relevance and potential impact.

**European SME export**

Despite attractive benefits, companies face challenges and barriers in exporting their products. Such barriers could be especially significant for SMEs, which have less resource to deal with activities outside their domestic market. On one hand, there are internal barriers related to the company itself and the product. On the other, there are external barriers related to the industry, market, and macro-environment (Cavusgil and Zou, 1994).

Internal and external barriers can both, directly or indirectly, impact on SCM and marketing of exporting SMEs. In particular, previous studies have commonly identified the following issues which may prohibit SMEs from exporting and/or affect SMEs’ export performance:

**SCM:**

- Transportation means and costs: transportation issues include the availability of transportation means, specific storage requirement, delivery time, and the costs associated with transportation and insurance coverage. Inconvenient or unavailable transportation means may prohibit the SMEs from exporting. High transportation costs could affect export performance, and/or affect the company’s competitiveness in the foreign market (Leonidou, 2004; Pinho and Martins, 2010).

- Warehousing and inventory management: besides space availability, specific facilities, proper safeguarding, geographic coverage might be required in warehousing. Inventory management has to take into consideration transportation delays, demand fluctuations, unexpected events, product returns and so on (Leonidou, 2004; Pinho and Martins, 2010).

- Distribution in foreign market/logistics: distribution in the foreign market and logistics issues include the access to distribution channels, competition in the distribution
Marketing:

- Information of foreign market and customers: lack of reliable information regarding the foreign market, and differences in customers' culture, attitudes and habits make it difficult for exporting SMEs to properly evaluate their business opportunities and to plan their marketing activities (Leonidou, 2004; Hutchinson et al., 2009; Arteaga-Ortiz and Fernandez-Ortiz, 2010).

- Product adaptation: exporting products are subject to different usage conditions, different tastes and habits, and so on. Adapting products for foreign markets requires deep understanding of the foreign customers; and consequently could increase costs and operation complexity (Leonidou, 2004; Pinho and Martins, 2010; Kahiya, 2013).

- Pricing in foreign market: export has extra costs in terms of product/packaging modification, transportation and administrative expenses, taxes and tariffs, and so on. In the meanwhile, exporting SMEs also have to compete with larger exporters as well as local competitors. Otherwise, SMEs should leverage on various marketing activities to establish themselves in niche market (Leonidou, 2004; Arteaga-Ortiz and Fernandez-Ortiz, 2010; Kahiya, 2013).

- Communication and promotion in foreign market: geographic and psychological differences, different laws and norms, different industry standards, etc., make communication and promotion in foreign market particularly challenging. Assessing the effectiveness of the communication activities and timely feedback could be more difficult in a foreign market as well (Leonidou, 2004).

- Aftersales service and relationship: due to limited human, financial, and allied resources, it is more difficult for SMEs to provide aftersales services, especially when it requires physical presence of personnel and/or spare parts. It is also more difficult for SMEs to establish and nurture relationships with their customers due to information unavailability, language barrier, and so on (Leonidou, 2004).

- Distribution in foreign market (naturally, a mutual issue of both SCM and marketing).

The New Silk Road

The New Silk Road initiative encompasses a wide range of topics including policy, infrastructure and facilities, trade, finance and investment, research and development and cultural communication (China Daily, 2015). In this paper, we emphasize the current development and operations under the initiative that particularly impact on SCM and marketing involved in trade, as summarized in Table I.

The rail cargo operated by China Railway Express provides a new alternative of transportation means between Europe and China. The rail cargo significantly shortens the delivery time to one-third of that of sea freight; while the cost is approximately one-eighth of that of air freight (CIRP, 2017). The 35 Chinese cities in the China Railway Express network have varying frequency and routes of operation. The main inland ports are aiming at establishing regular, frequent and efficient scheduling in order to improve service consistency and to further reduce costs.

Besides rail cargo, the main inland port cities are investing in developing logistics hubs as well. For example, one of the most important port cities, Chengdu, has already built
warehouse equipped with specific facilities such as refrigeration. It plans to further develop logistics services, financial services, processing and handling, and distribution services (CIRP, 2017).

Most rail cargo operators are developing their domestic networks as well, so that the containers departed from Europe could be seamlessly delivered to other Chinese cities. Exporters could also exploit the bonded warehouse in many main ports, and to distribute to the market through the domestic logistics networks and distribution channels. Such logistics networks and distribution channels are already established. The port cities are, however, making an effort to integrate the existing networks into the New Silk Road initiative in order to facilitate effective communication between the Chinese service providers and the European exporters.

As we can see in Table I, the current developments and operations under the New Silk Road initiatives have mainly been addressing SCM issues. On the marketing side, the only substantial impact is on pricing. Trade policies are being adjusted to incentivize especially consumer goods (Zhou, 2017). The free trade zones allow products to be imported (and re-exported) without being subject to customs duties until they are moved to the consumers, thus reducing the initial financial constraints on the exporters (Yao and Whalley, 2016). Nonetheless, these measures do not effectively support the exporting SMEs to make the pricing decision. Overall, European SMEs are still facing significant marketing barriers under the New Silk Road initiative.

<table>
<thead>
<tr>
<th>SME export barriers</th>
<th>New Silk Road measures</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCM</strong></td>
<td>Rail cargo operated by China Railway Express provides an alternative transportation means</td>
<td>Under steady development</td>
</tr>
<tr>
<td>Transportation</td>
<td>Inland logistics hubs provide warehouse, special facilities, and other value-adding services</td>
<td>Under steady development</td>
</tr>
<tr>
<td>Warehousing</td>
<td>Domestic logistics network and distribution channels</td>
<td>To be integrated</td>
</tr>
<tr>
<td>Distribution in China</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marketing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market information</td>
<td>–</td>
<td>To be developed</td>
</tr>
<tr>
<td>Product adaptation</td>
<td>–</td>
<td>To be developed</td>
</tr>
<tr>
<td>Pricing</td>
<td>Trade policy adjusts tariffs; “Free-trade zone” policy reduces financial constraints</td>
<td>In place, to be monitored</td>
</tr>
<tr>
<td>Communication and promotion</td>
<td>–</td>
<td>To be developed</td>
</tr>
<tr>
<td>Aftersales and relationship</td>
<td>–</td>
<td>To be developed</td>
</tr>
</tbody>
</table>

Table I. SME export barriers and New Silk Road measures

The role of Chinese importers

According to the China Railway Express operators, the majority of trade flows from Europe are in fact sourced by Chinese importers, who often arrange the transportation, manage warehousing, and act as the distributors in Chinese market as well. Chinese importers are at the forefront of commissioning the rail cargo because of their naturally closer relationship with the China Railway Express operators and earlier access to information. They then monitor the transportation process, which has been streamlined by the railway operators and the inland ports, coordinating with the railway operators. Finally, they manage the warehousing and the distribution of the imported products, leveraging on their logistics network, distribution channels, and eCommerce capabilities. Therefore, the importers are critical partners for European SMEs, who provide vital support for both SCM and marketing in export activities.

However, except some mature trade relationships, often with larger European companies, many European SMEs and Chinese importers still struggle to establish
long-term-oriented and mutually beneficial relationship. Cultural distance, communication barrier, opportunistic behaviors, and so on, could hinder the development of such relationship (Nes et al., 2007; Katsikeas et al., 2009; Barnes et al., 2010). However, supportive relationship between importers and exporters are found critical to export performance (Skarmeas and Robson, 2008; Sousa and Bradley, 2009). As the New Silk Road opens doors to more European SMEs and new importer-exporter relationships, the Chinese importers can be the main driving force to lower the marketing barriers for exporting SMEs, and the main actor in the SCM.

SCM-M integration through stronger exporter–importer relationship

The New Silk Road initiative has stimulated the development of infrastructures and services which offer alternatives and lower barriers in SCM for companies wishing to export to China. However, few measures are in place to address the marketing barriers for exporting companies, which can be especially relevant to SMEs which have fewer resources to manage such process. Currently, the Chinese importers are already playing an important role enabling European SMEs to export to China through the New Silk Road, and they are actively involved in both SCM and marketing for the imported products. However, the exporter–importer relationship can be much further strengthened for mutual benefits.

In SCM, the cross-border transportation and customs procedure are already streamlined. The involvement of importers could facilitate effective communication with the railway operators and potentially efficient cargo management due to economies of scale. More importantly, importers can be especially valuable in managing the distribution of imported products in Chinese market. Chinese market is often difficult for European SMEs to navigate due to its vast size, internal diversities, different distribution structure, and so on. Most European SMEs do not have sufficient knowledge and resource to manage the distribution. On the other hand, importers understand the Chinese market much better. They often have established distribution channels and eCommerce platforms. Certain inland ports have services facilitating the distribution in Chinese market, for example, the inland port of Chengdu has a showroom and its own eCommerce platform for promoting products imported through its port. In such case, the importers can also coordinate the distribution efforts more effectively. Through a stronger relationship between each other, European SMEs could benefit from an easier exporting process, lower costs, and less resource constraints, while the Chinese importers could improve efficiency and enjoy economies of scale.

In marketing, there are much less New Silk Road measures directly impacting on exporting SMEs’ marketing activities, even if it is one of the most important factors influencing SMEs’ export intention and performance. Nonetheless, the marketing barriers could be tackled through a stronger relationship between the exporting SMEs and the importers. With their knowledge of Chinese market and Chinese consumers, the importers could promote mutual understanding of the market opportunities for the exporters, and assist the exporters to define their marketing mix for the Chinese market. On the other hand, the exporters should be more involved in the process to provide support to the importers. For example, the exporters could be cooperative in adapting product according to importers’ market intelligence. The exporters should also equip importers with product knowledge for developing marketing communication with the Chinese consumers, and participate in marketing communication wherever resource allows. Through a stronger relationship, the European SMEs can develop more suitable marketing mix for Chinese market, develop market and customer knowledge, possibly build customer relationship, and eventual build brand equity in Chinese market. The Chinese importers over time could develop product specific knowledge and count-of-origin specific knowledge, and improve their marketing competencies.
New Silk Road and business process management research: just a new setting or a new domain?
The most notable developments achieved so far under New Silk Road initiative are the railway and other logistic infrastructures. However, new means of transportation of goods merely creates a new setting for the trade between China and Europe. Business process research needs to do no more than validating and updating established knowledge in export and import. Nonetheless, it would be unlikely to achieve significant category expansion and deep economic integration in such approach; and it essentially competes with the existing transportation modes. As the New Silk Road initiative does not aim to simply replace sea/air freight by providing alternative transportation, it requires businesses to reimagine on both sides. Therefore, it potentially creates a new domain for business process research.

In particular, even if there have been plenty studies on SME export and SCM and marketing in export, the New Silk Road opens up new research avenues in these topics. Due to its novelty, very few studies in these areas are available. However, as the infrastructure development progresses and the rail cargo operations continues to increase, the stakes rises for all parties involved. Therefore, it is high time that the research community starts to contribute to the knowledge building in this initiative. Stemming from the above discussion, we propose several research areas in SCM and marketing in SME export, in which the New Silk Road has unprecedented impact on businesses.

What are the business model(s) to be innovated under the New Silk Road initiative? The New Silk Road has made substantial efforts in providing supply chain alternative and in streamlining the supply chain operation. However, there are still significant marketing barriers hindering European SMEs’ export activities, and therefore the potential success of the entire project. We have proposed that the Chinese importers should strengthen the relationship with European SMEs and play a bigger role in exporting marketing. Policy-makers both in China and in Europe could also make an effort to develop measure aiming at lowering marketing barriers for SMEs. In either case, traditional export mode will be challenged.

Traditionally, international trade has been studied in a producer-driven vs buyer-driven logic, which explained export-import activities with the search for resource, market and cheap labor (Gereffi, 1994). As Gereffi (2001) later has noted that the rise of internet would cause an evolution beyond the producer-driven and buyer-driven dichotomy, another evolution can be expected under the New Silk Road initiative since the traditional search for resource, market or cheap labor barely explains the motivation for trade in this case. Export has also been considered a low commitment mode of foreign market entry. With increasing level of resource commitment, exporters could explore contractual agreements (licensing, R&D contracts, alliances, etc.), equity joint ventures and wholly owned subsidiaries with their foreign partners (Pan and Tse, 2000). Similarly, such hierarchy may not be sufficient to explain the choices for companies to enter a foreign market as the dynamics between the exporters and importers undergo changes.

Therefore, moving from the traditional trade of good, various areas in current business models could undergo significant changes when companies reconfigure their business process in the new exporting or importing context. Instead of simply being the source of products or the distribution channel, European SMEs and Chinese importers could strengthen and extend their relationships towards certain contractual agreements, particularly aiming at attenuating the marketing barriers. Through such partnership, European SMEs could gain a valuable resource of market knowledge, which allows them to focus on their key activities and to fine-tune their value propositions through a stronger customer relationship. Chinese importers should exploit the partnership to gain product knowledge, develop stronger marketing competences as value proposition, expand their key activities, and develop distribution channels to better connect the manufacturers to the consumers. As Pressey and Tzokas (2004) suggested, affective and calculative relationships between exporters and importers would decline over time, while appreciation of competencies nurtures long-term
relationship with mutual benefits. In order to co-create competencies between exporters and importers, new businesses and business models could be born among these changes as well. Profitable and sustainable business model innovations directly impact the success of the exporting SMEs, the importers, and the New Silk Road initiative as a whole.

Which are the contingent factors to be taken into account in business process research under New Silk Road context? European companies, regardless of size, which are already exporting to China, are obviously potentially clients of the New Silk Road’s rail cargo. However, focusing on such companies will create a direct competition between the new transportation mode and the traditional ones; and it will not effectively achieve the objective of boosting trade and expanding the trade categories, especially of consumer goods. Therefore, the large number of European SMEs who are not actively exporting yet should be investigated.

We have discussed the factors in SCM and marketing that are inhibiting SME export, and the New Silk Road is changing the dynamics in some of these factors. Shorter delivery time (and shorter cash conversion cycle) compare to sea freight, lower cost compare to air freight, easier access to logistics facilities and distribution channels, and so on, could change the feasibility and attractiveness of exporting traditionally perceived by European SMEs. Whether such change is desirable is yet subject to product characteristics, such as the profit margin, dimension, shelf life, storage requirement, product fit in Chinese market, country-of-origin strength, and so on. As summarized by Leonidou (2004) and Tesfom and Lutz (2006), literature generally suggested that developing or adapting new products for foreign market and quality standards are some of the major product-related barriers for SMEs due to limited resource. However, in the context of New Silk Road, these variables need to be examined under a different light. The initiative is partly driven by Chinese consumers’ increasing appetite for authentic, high quality European products. The equilibrium between authenticity of European products and the fit to Chinese market, and the quality perception of the SMEs’ products comparing to their high-end-branded competitors have not been addressed by literature before, which opens up an interesting research area from the marketing perspective. Furthermore, such research could integrate with an SCM perspective to allow the identification of the industries that are most promising to benefit from the New Silk Road initiative. The research results could provide guidelines for policy-makers and the importers, in order to make effective use of their resources. They could also inform European SMEs about their potential market opportunities, and provide them preliminary information to assess their strength and weakness in pursuing the export opportunity.

What is going to be the new price perception? European products traditionally have the “luxury” image in Chinese market, largely because the high-end manufacturers have long been exporting to China. One of the aims of the New Silk Road initiative is to democratize consumption of imported products, by reducing costs in cumbersome process, lowering tariff, and expanding beyond the luxury labels. Pricing in export is no stranger in research community. As Tan and Sousa (2011)’s exhaustive review suggested, despite considerable amount of work done, the knowledge in this field was still rather fragmented and they have pointed out, in particular, that consumer perception of pricing had seldomly been considered in export pricing. In reality, consumers’ price perception has been an important factor for the imported (usually high-end) products in Chinese market (Chen and Lamberti, 2015). Pricing of imported products have not been an easy task in China due to asymmetric product information, credibility issue, and so on. It would be a challenge for the European SMEs who are new to Chinese market to identify their right price; it would also be a renewed challenge for incumbent exporters to adjust to the new condition.

In the past many research have studied the symbolic value and price perception of foreign high-end products by Chinese consumers. The market situation may shift when more main-stream, yet unfamiliar products enter Chinese market. On one hand, marketing
research could extend the studies of consumers’ value and price perception to the new categories imported through the New Silk Road. Marketing research could also investigate how the incumbent European exporters’ pricing might be affected by the new market dynamics. On the other hand, the cost structure along the supply chain could be subject to important changes to traditional export and impacts on the exporters’ pricing strategy, which could be investigated by SCM research.

**What will be the optimal distribution strategy?** Distribution and logistics used to be considered a critical difficulty for exporters in Chinese market, due to under-developed infrastructure, fragmented network, bureaucratic restrictions and the vast geographic size (Jiang and Prater, 2002). However, this situation has been dramatically changed in the last decade. The prosperous development of eCommerce and the third-party logistics (3PL) sector in Chinese market has made distribution a lot easier for exporters (Yeung et al., 2012). Cross-border eCommerce, despite a seemingly promising prospect, still struggles with problems such as unreliable and lengthy delivery time, limited transparency on delivery, ambiguous return process, custom bureaucracy and so on (van Heel et al., 2014). New Silk Road’s measures, such as delivery trackability, network integration, bonded warehouse and so on, may easy some of these problems. Nonetheless, high competition and regulation (major eCommerce platforms exercise a seven-day guarantee of product return) in delivery service is still pressuring exporters to carefully plan their logistics network, in order to ensure customer satisfaction. Furthermore, Chinese consumers embrace “showrooming” in their shopping process, therefore physical retail space is still important. The New Silk Road initiative is dynamically changing the possible approach to distribution as warehousing facilities and logistics services are being specifically developed for exporters. Current research has not created substantial knowledge in these aspects.

SCM and marketing research should join force in the search of an optimal distribution strategy. On one hand, it should understand how European SMEs and the Chinese importers should leverage showroom and eCommerce to promote imported products that are still novel to the market. It should also understand the optimal service level for order fulfillment. On the other hand, the number and location of warehouses, 3PL and other logistics partner networks, management of delivery and return, and so on, need to be designed in order to balance the market expectation and the operation costs. Policy-makers may also benefit from such research to plan the future infrastructure development.

**How should cultural differences be managed?** The impact of cultural difference is always a relevant topic in international business. Naturally, for an initiative aiming at encouraging integration among China, Europe, and many other countries in between, culture is an inevitable issue. Cultural difference has already been studied both in SCM and in marketing. In supply chain, culture plays an important role in supply chain partner relationships (Jia and Rutherford, 2010). In marketing, culture has profound impacts on virtually all steps in the marketing process in a foreign market (Magnusson et al., 2013). A stronger partnership between the European SMEs and the Chinese importers should ideally reduce the cultural barrier between foreigner manufacturers and Chinese consumers, with the importers being the cultural bridge. However, cultural barriers between the organizations are also more relevant than ever when a greater integration and a stronger partnership are desired.

Therefore, SCM and marketing research should also take a cultural and organizational perspective. In the case of New Silk Road, it could be a highly stimulating research area. Culture has always been an interesting factor in international management studies (Steenkamp, 2001). However, the current knowledge falls short in the context of New Silk Road initiative. First of all, New Silk Road connects many inland cities directly with Europe, in addition to the traditional sea-port cities. As the inland cities presenting themselves to the outside world, their respective local cultures, which could be rather different from each other,
come into play. This affects both the understanding of the market (Chen and Lamberti, 2015), and the relationship between companies (Chan et al., 2010). Most of the current studies have stayed on the national level. Second, Europe is also characterized by diverse national and sub-national cultures. In addition, European SMEs are extremely high in number and are more likely influenced by different cultural factors, such as family, territory, personal believes, and so on. A general “western culture”, as being referred to in many studies, not necessarily suffices when the importers deal with partners from different European nations (Gursoy and Umbreit, 2004). Appropriate organizational process, which allows both sides to understand their differences and to seek mutually beneficial middle ground, is essential to a true integration.

Contributing to the shaping of New Silk Road
The New Silk Road is a vast and long-term project with many aspects yet to be defined by the Chinese policy-makers. European counterparts and industries and businesses from both sides undoubtedly should also take part in influencing these definitions. In this paper, we specifically look at the trade opportunities for European SMEs to Chinese market. We argue that even if the current infrastructure development under the New Silk Road Development lowers certain logistics barriers for European SMEs’ export, yet more has to be done to lower the marketing barriers as well. We proffer that Chinese importers should expand their role from a traditional supply chain partner to an essential marketing partner, through a closer integration with the European manufacturing SMEs. We discussed several future research areas under this proposal. We warmly welcome future research to contribute to the management and policy making in this impactful project.

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Abstract

Purpose – The purpose of this paper is to reshape and interpret the essence of marketing–supply chain management (M–SCM) interface in the glance of the dramatic changes occurring in competition and market relationships.

Design/methodology/approach – By reviewing relevant literature and analyzing evolutions in the different phases of the marketing funnel, the author develops an evolutionary pattern for M–SCM interface.

Findings – As the markets evolve to an always-on, service-dominant logic, being market-driving becomes a necessary condition, and as such marketing strategies must be capable of reconfiguring supply chains to reshape the value for customers. This implies a dramatic organizational change, even beyond mere technological issues.

Originality/value – The paper aims at setting some research directions for business process management and organizational patterns to govern M–SCM interface.

Keywords Marketing, Supply chain management, Marketing strategy, Business model evolution

In the business community, there is an overwhelming trend of technology – big data, digital devices and artificial intelligence – being used for any business and marketing strategy.

In reality, the humans are, and should be, still in the center of both back-end and front-end business operations. After years of dreaming of completely automatized production systems and supply chain, the smart manufacturing puts human back to the center, acknowledging that the (often tacit) knowledge on business processes is the key to their proper functioning (Seethamraju and Marjanovic, 2009). The human centrality is even more evident in marketing. The consumers have certainly gained much more bargaining power compare to the past, as the result of disintermediation between individuals and brands, and the diffusion of social networking platforms (Kucuk and Krishnamurthy, 2007). The decision-making dynamics, however, remain complex and far from codified: scientific literature suggests that a large part of the purchase decisions derives from emotions, instead of being a result of rational reasoning on factors such as price (Bagozzi et al., 1999; Lerner et al., 2015).

This does not mean to deny the evidential fact that businesses are going through probably the most profound transformation in the recent industrial history (Vargo and Lusch, 2004). They need to set up important projects managing the changes. However, such transformation needs to take place in the right perspectives, in which digital technologies are extraordinarily important, yet purely instrumental.

In such perspectives, marketing should take a new role which is even more pervasive, building on two pillars.

In the first place, there is the central objective of strengthening brand equity. Today’s consumers are facing decisional processes even more complex than those in the past: multiple touchpoints, offering varieties, and explosion of information with varying credibility.
Thanks to just this consciousness, we can understand the (renewed) centrality of brand: the strength of a brand lies in its capacity of responding, with multichannel perspectives, to the needs of the consumers who navigate an increasingly intertwined market context (Tsai, 2005; Baxendale et al., 2015). As such, brand trust is paradoxically elevated that a brand becomes a relationship in which the value proposition of a business offers is more and more a combination of “what” and “how,” responding to the consumers.

In the second place, there is the need of interpreting the purchase process under a new light. Businesses used to consider the phases of shopping controllable from both spatial (point-of-sales) and temporal (the classic marketing funnel) perspectives. The rise of everywhere and everytime commerce must bring a decisive change of view, which suggests that it is fundamental for marketing managers to exercise certain control over the phase in which the need of purchase emerges, rather than the spatially and temporally undefined activity of purchase itself (Baxendale et al., 2015). Note that it does not deny the importance of the physical contacts but emphasizes the specific and fundamental capacity of the physical contact points which could facilitate the consumers to experience the products through five senses, in a multichannel purchase process (Hultén, 2011; Scott and Uncles, 2018).

As such, the necessity of a new action plan for businesses clearly emerges, in which businesses should be loyal to the consumers rather than demanding the consumers’ loyalty. This requires intimacy and profound understanding of the customers, i.e., the data and information for qualifying and interpreting interests, behavior and actions/reactions of the individuals exposed to marketing stimuli (Hofacker et al., 2016; Hsu, 2017). Marketing, and the marketing machine, become a new business operation cycle which has the same relevance that the production has had for all manufacturing enterprises until today. The new value proposition combines the “what” offered by the business and the “how” it relates to the market over time. Under this framework, marketing becomes strategy, and vice versa. The change in the market requires profound transformation in the offer system and in the businesses, questioning models such as the ones proposed by Porter in the 1980s that have significantly influenced how businesses have defined their strategies until today (Barney, 2014). The shift of a business’s competitive advantage toward the market raises several important implications that we will discuss here in order to clear some assumptions that are no longer fully in line with the competitive environment:

- Good marketing/strategy today no longer means to continuously adapt the offer to consumers’ changing needs. In this respect, the business community must take into account two key aspects: take actions that could prevent the consumers from making a different purchase choice, by creating cumulative advantages that make the choice of a certain brand a habit (Kumar and Reinartz, 2016); and be able to proactively guide the consumers’ desires, proposing products that no market research has identified to be desired by the market itself, i.e. adopting a market driving, rather than a market-driven approach (Kumar et al., 2000). This implies working on reshaping supply chain in order to reconfigure the essence of competition and the value for customers (Elg et al., 2012; Ghauri et al., 2016), and for this reason requires more dyadic and dynamic relationships between marketing and supply chain management (Juttner et al., 2007).

- Competing to win in the consumers’ minds not only requires a superior product. A business wins when it manages to assert its own criteria of choice, in which its offerings excel and its brand identity is founded, in the evaluation process of the individuals (Kumar et al., 2000). In this way, the brand becomes synonym of this set of criteria, and the business goes beyond satisfying a market demand, but determines what the market desires.
• The products continue to be an important part of business processes to materialize the defined positioning. However, they do not represent the entire value proposition. The products are naturally enriched through levers such as communication and distribution, which qualifies the dimension of process in a value proposition (Kozlenkova et al., 2015).

• Technology and R&D are certainly important determinants of a business’ success, but they are not all that it takes. In fact, as seen in the so-called sharing economy and the network economy, they could be the subject to appropriation of the third-parties (Park, 2017). Therefore, it is important working on different dimensions capable of understanding the market and developing capacity of planning and promoting attractive experience for the target market.

In conclusion, the dual force transformation in the market changes not only the marketing that we know but the entire business. On one hand, digital transformation penetrates the systems of interaction; on the other hand, the functioning of human mind, emphasizing its emotional side, is assuming an absolutely vital position. The complexity of the context, multiplicity of stimuli, large-scale availability of information: all the new advances should drive the management to analyze with greater attention the interaction with consumers, and to question what are the new forms of value that could reduce costs and risks for consumers? In other words, a new value chain is required, in which marketing will make more and more important differences from competitive and managerial points of view.

Therefore, the evolution of the interface between marketing and supply chain management first lies in the organization, even before the process or technology, with increasing weight on the design and the deployment of an effective architecture of interactions with the market. Literature has investigated organizational issues both in marketing and supply chain management. For example, in the marketing literature, different organizational behaviors were discussed including customer orientation, competitor orientation, innovation orientation and internal/cost-orientation (Kohli and Jaworski, 1990; Day, 1994; Christensen and Bower, 1996). In supply chain management, organizational issues include inter-organizational factors, inter-organizational factors and environmental factors (Cao et al., 2015). Organizations develop their capabilities, recruit and acquire resources, and plan activities according to their strategies (Olson et al., 2005).

Literature, however, has not particularly investigated the organizational issues in the integration of marketing and supply chain management. As such, we warmly encourage research efforts on the inter-organizational dynamics for this interface, on matching the profiles of sales and engineering, on the capacity of collecting and sharing the market insights, including the emotional ones, and moving them upstream. Researchers may extend the previous studies of organizational issues of the two individual disciplines to their integration. Such a focus is needed also because value innovation has been pointed out as an interactive, knowledge-generating process through which intra- and inter-organizational relationships with supply chain empower the company’s capability to operative and reshape their own market (Berghman et al., 2012; Sebastiao and Golicic, 2008). For this reason, we warmly encourage to deepen the essence and the success factors of this process, as well as the organizational conditions and contingencies fostering its efficiency and effectiveness, as a key to fully capture the value generation opportunities enabled by the current evolution of markets.

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