

## Open Innovation in Supply Chain Relationships: Analysis of a Creative Sector

Maria Rosaria Marcone\*

*Abstract:* The article focuses on the development of innovative supply relationships that allow the use of openness innovations. At the same time, firms that want to implement these innovations must redesign their production processes. The research is based on an in-depth study of 10 business cases of medium-sized firms belonging to a clothing sub-sector, that of knitwear. The findings have important managerial implications considering that the innovative supply chain processes, in which a leading role is assumed by firms operating in the so-called traditional manufacturing sectors, generate an increase in flexibility of the entire supply chain.

*Keywords:* supply chain risk management; open innovation, new process-product re-engineering.

*JEL:* O32, M11, M21

### Odperte inovacije v odnosih z dobavno verigo: analiza kreativnega sektorja

*Povzetek:* Članek se osredotoča na razvoj inovativnih odnosov s ponudbo, ki omogočajo uporabo inovacij odprtosti. Hkrati morajo podjetja, ki želijo uvesti te inovacije, preoblikovati svoje proizvodne procese. Raziskava temelji na poglobljeni študiji 10 poslovnih primerov srednje velikih podjetij, ki spadajo v oblačilni podsektor, tj. pletenine. Ugotovitve imajo pomembne menedžerske posledice, saj inovativni procesi dobavne verige, pri katerih vodilno vlogo prevzamejo podjetja, ki delujejo v tako imenovanih tradicionalnih proizvodnih sektorjih, ustvarjajo večjo prilagodljivost celotne dobavne verige.

*Ključne besede:* dobavna veriga; obvladovanje tveganj; odprte inovacije; novi procesi reinženiringa izdelkov.

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## 1 Introduction

The study investigates the positive evaluation of the outputs of innovation, as well as the impact that innovative relationships between producers of knitwear and up-stream economic actors (suppliers, start-upper, etc.) have on the flexibility offered to the industrial clients, retailers and, ultimately, the end market. In fact, unusual and innovative supply relationships lead knitwear firms to widely diversify the supplier portfolio, increasing the riskiness of procurement activities and supply relationships (supply chain risk management – SCRM).

Outputs of innovation are considered increasingly important in SMES (Marullo et al., 2020; Nasiri et al., 2020) in response to a scarcity of studies (Bican and Brem, 2020). This investigative work promotes methodological

research approaches to analyze and perhaps also to interpret the uncertainty that, generated by the different and unusual innovative supply-side relationships, will have effects on future competitive scenarios.

This study aims to analyse more specifically the effects that the innovative relationships in supplies generate on the productive processes that must sometimes be reconfigured in a radical way.

The companies, that are investigated, are those that produce knitwear and are particularly competitive at an international level (the import-export rate covers or represents a large part of the turnover) and open to innovative phenomena not usual for creative companies of Italian fashion.

As far as the work structure is concerned, in the first part the research hypotheses are indicated, then the methodology followed in the research and the topics that have been investigated during the empirical investigation are illustrated. A part of the text is dedicated to the analysis and interpretation, in a managerial sense, of the useful observations that can be deduced from the empirical investigation. Finally, some concluding thoughts are presented, and some possible limitations of the research are hypothesized.

## 2 Theoretical framework

The purpose of this study is to analyse the improvement of the economic results that arise from the management of the areas of R&D operations and the improvement of outsourcing performance in the design of innovative relationships with knitwear firms and new and unusual suppliers for the sector to which they belong.

The dominant theoretical perspectives in supply chain management are the transaction cost economics (TCE) (Williamson, 1975), the resource-based view (RBV) (Wernerfelt, 1984; Barney, 2012) and knowledge-based view (KBV) (Nonaka and Takeuchi, 1995). However, such a framework does not allow one to interpret the problems of the value that the up-stream actors of the supply chain (industrial buyers and their own direct suppliers) expect to increase with each business relationship (practically, that it increases for both with every single order) (Corsaro and Snehota, 2010; Spina, 2016; Johnsen, 2019).

We want to verify through a field analysis (empirical research which makes use of a longitudinal analysis) whether the relational theory can appear suitable for the understanding of the phenomenon of value creation in modern supply chains and more precisely to interpret the 'supply side' relationships that characterize the innovative (innovative in the sense of unconventional) processes of creating new products (new product development – NPD - processes) and sometimes the experimental innovative processes that radically modify entire production chains or significant parts of them. Some studies focus the attention on the value that supply chain relationships generate for the customer (intermediate customer or final-end user) and, noting that they concern upstream stages of the supply chain itself, highlight the role that suppliers can play in increasing the value offered to the stages further down the respective supply chains (Walter et al., 2001; Möller and Törrönen, 2003; Eggert et al., 2019).

The purpose of this empirical research field is to understand how the consistency between competitive objectives of companies that are part of complex innovation strategies and perceived competitive uncertainty, which is for our study determined by technology (disruptive innovation in production processes, product design activities, new materials) and problems related to supply (availability of fine materials such as cashmere), might affect supply chain flexibilities that cope with supply chain risk. Perceived competitive uncertainty is the primary and the critical driver of supply chain flexibility even in firms that belong to a sector, that of knitwear, part of the Italian fashion system.

This is a flexibility that permeates the entire supply chain and makes it adaptable (a sort of dynamic resilience) to the disruptive innovative events that are formed and developed within specific companies, such as start-ups, and all within other industries or supply chains. An example of this, are those sectors that are often new or even emerging sectors of sustainable biochemistry, nanotechnologies, etc.

A higher level of supply chain agility (and perhaps also a high level of supply chain integration) have also been shown to have a positive impact on firm business performance (Flynn et al., 2010; Gligor et al., 2015).

To the extent that flexibility constitutes an adaptive response to environmental uncertainty and operational risks (Sreedevi and Saranga, 2017; Tang and Tomlin, 2008), it is important to understand when and how such a response arises.

In this study the flexibility of innovative business activities has been analyzed. These activities were practically detected in the field with the ability of knitwear producers to offer a mix of innovative processes which in turn generate an extremely varied mix of fashion collection designs.

Factors including rapid technological development, the advent of innovative processes openness that involve sub-sectors belonging to diversified supply chains (especially at the 'supply-side' level), shorter product life cycles, more diversified and customized demand and fierce marketing competition make today's competitive strategy choices increasingly unpredictable and risky.

To the extent that flexibility constitutes an adaptive response to environmental uncertainty and operational risks (Sreedevi and Saranga, 2017; Tang and Tomlin, 2008), it is important to understand when and how such a response arises.

The following is assumed.

*H1. Flexibility improves a partner's ability to adapt to situations that may arise unexpectedly in the future.*

Relationships with other supply chain players, especially suppliers in innovative openness processes are complex and since they were recently formed, there is no shared value phenomena in innovative relationships.

The literature on open innovation has grown exponentially in the last decade, but the current commitment of scholars and managers is to grasp the latest challenges presented by this research field such as different propositional research logics, above all it is necessary to deepen how firms can implement various forms of open innovation in practice and what consequences such initiatives have on the relationships within supply chains (Appleyard and Chesbrough, 2017; Remneland and Styhre, 2017; Chesbrough et al., 2018).

Investigated firms need to handle inter-organizational relationships with value creation partners, such as suppliers, which become, albeit on a contractual basis, manufacturing, and R&D partners. 'Learning by R&D outsourcing' is a phenomenon characterized by a specific relationship between the firm and the source of R&D (Un and Rodriguez, 2018). In the case of 'learning by R&D outsourcing', our focal firms, in the supply chain system, take a collaborative role in the development of innovations and works with others to integrate expertise and co-develop innovations. In addition, they benefit from the redesigned production processes.

It is therefore assumed that:

*H2. The supply integration of the knitwear production systems is positively related to higher levels to the ability to efficiently redesign innovative production processes.*

Supply chain capabilities refer to the ability of a firm to identify, utilize, and assimilate both internal and external resources/information to facilitate the entire supply chain activities (Wu et al., 2006). This work is part of the research that argues that the internal knowledge is more likely to provoke radically new innovative processes (Whitehead et al., 2016; Linder and Sperber, 2019).

It has been claimed that by generating new technological knowledge through high levels of internal R&D, a firm acquires knowledge that is different from that entirely embedded and may conflict with its existing knowledge. It emerges from some studies that it would be difficult to initiate and manage innovative processes by leveraging exclusively on the research activities developed within the company: a curvilinear relationship was even detected (i.e., decreasingly positive) between internal R&D and product innovation performance (Heij et al., 2020).

In practice, it seems that it is easier (or more usual) for the management of small manufacturing companies to know how to make innovative principles processable, in a productive sense, perhaps created in other areas (sectors, companies, start-ups, etc.).

The companies that produce knitted garments, unlike other companies in the Italian fashion system (such as those that produce fashion clothing), carry out the weaving activity (internal preparation of the knitted tissue) internally, which is capital intensive. That is, they have a production cycle that takes place completely internally (integrated production cycle) and have always created new yarns, involving the yarn suppliers in advance. It has always emerged that especially in the weaving phase, applied knowledge, that is manufacturing know-how, is the basis of internalization of external innovative phenomena (open innovation). Without wishing to delve into open innovative phenomena in this study (open innovation, crowdsourcing, innovation communities, etc.), we want to investigate

whether R&D applied to operations activities can favourably support new and unusual manufactured-based innovative processes for not large creative manufacturing companies of the Italian fashion system.

Existing internal knowledge, operational structures and production processes form the utilized resources as cornerstones for value offerings in open innovation. Firm innovating efficiently might also help the value of the product to grow better (West and Borges, 2017; Hernandez-Vivanco et al., 2018).

Nevertheless, over-innovation search and collaboration phenomena might reduce the innovation returns (Greco et al., 2016). Moreover, it is proposed that the best practices in innovative operational processes are those based on generation or exploration, in accordance with the input-output model for measuring the performance of innovative business processes (Goffin and Mitchell, 2005). Internal and external knowledge creation oriented towards innovation in products and processes contribute positively and significantly to innovation performance.

*H3. The greater the embedded knowledge in internal R&D and operations activities, the more frequent and better implementable the innovation strategies in the innovative processes are.*

### 3 Research methodology

The firms investigated are those that, within the conspicuous sample of firms, belonging to the Italian fashion system and investigated by myself in the last eighteen years, produce knitted garments and are particularly competitive internationally and open to innovative phenomena that are not usual for creative companies of Italian fashion.

As far as the methodology adopted is concerned, a longitudinal analysis has been followed for some time, making use of the observation on the field of the international strategies of ten excellent companies in the sector: the management phenomena that emerge in the various managerial areas are interpreted; balance sheet data and competitive performance of companies that excel in the Italian knitwear sector are monitored. It is preferable to embrace a dynamic industry model with heterogeneous firms, terms of resources, types of innovative choices, productivity of innovative processes): the so-called self-selection literature.

To gather insights related to the three research questions, ten in depth investigations were conducted in the last ten years with entrepreneurs, managers and executives involved in the NPD process with trusted and usual innovative suppliers and with crowdsourcing efforts in the 10 innovative openness processes of 10 fashion creative firms.

Data were collected through a series of semi-structured interviews with workers belonging to various business areas (operations, office style, R&D, marketing) and with external factors such as yarn suppliers, buyers, institutional and non-institutional lenders.

An interpretative, qualitative approach - using selected multi-case study interviews (Yin, 2003) such as the primary data collection method - is chosen because it helps to navigate and understand the complex issues that are associated with the data quality concept, and its relation to the factors involving managerial practices to implement facilities in modern relationships within the international supply chain. 'Oriented case studies' investigate the issue within a real-life context, drawing on the reviews of a number of sources, and provides the means to review theory and practice iteratively (Ellram, 1996; Flynn et al., 2010; Hennenberg et al., 2010). Multiple cases ensure that common patterns are identified rather than generalized (Eisenhardt and Graebner, 2007).

#### 3.1 Research design

Some variables were considered useful to highlight the innovativeness of the companies in openness supply relations and above all the impact they had on the competitiveness of the companies of the sample investigated (table 1 and sheet 1).

Table 1: variables considered to be out of limits for innovative supply processes

<i>Outcomes</i>	<i>Detail level</i>
Operational aspects	a. Operations-based challenges b. Input cost-based challenges
Market aspects in product development creative processes	c. Kinaesthetic value d. Rational value

<i>Outcomes</i>	<i>Detail level</i>
Economic aspects	e. Profitability of the firms f. Productive know how improvement g. Employment opportunities h. Economic impact for other stakeholders
Knitwear-suppliers relationship	i. Relationship specific aspects j. Specific factors at the micro-level analysis

Sheet 1: meaning attribute to the detail variables (column 2 of table 1)

- a. They are based on business process re-engineering activities that increase the efficiency of the NPD and manufacturing processes.
- b. It is a variable that has been investigated, as it is considered important, and is represented by business processes re-structuring, which aims to make costs more efficient.
- c. It is an investigated variable, in order to evaluate the impact of innovative project activities, implemented in the development processes of new products, in order to increase the kinesthetic value of the product and precisely the emotion, the donning and the safety.
- d. This is another attribute of the project activity for the development of a new product: the rational value increases the opportunity in the use of the product.
- e. ROI and cash flow of the collection are the main variables that have been investigated in the course of the empirical survey, in order to evaluate the economic-financial impact of the design activities for each fashion collections.
- f. We wanted to verify if the increase in know-how has generated an improvement in productivity of workers and capital.
- g. We have tried to investigate, on the one hand the growth of the know-how of workers, on the other the creation of new employment opportunities especially for the surrounding territory.
- h. We wanted to verify if the companies of the sample produced positive innovation spill over effects.
- i. Regarding the specific factors of the relationship, the following factors were required: relationship age and shared business volume.
- j. As for knitwear-supplier relationships, these were typed and analysed based on the innovative nature of innovative suppliers (type and number) and on the dynamism and complexity of each innovation project.

Firms, for each of these variables, have been assigned a score ranging from 1 to 5 and interesting results emerge from the observation in figure 1.

#### 4 Supply chain openness activities: some empirical evidence

In an accelerated competitiveness of the supply international structures, it is possible to think that creative firms create new products and processes often in an improvised manner. Extemporaneous inter-organizational collaborations in a 'supply side sense' thus is inevitable and has increasingly triggered scholarly interest due to its potential value in building innovative knowledge and capabilities in diversified supply chains that relate to each other in an unthinkable way compared to the recent past. Such improvisation is a key factor at the centre of the broad concept of resource slack, intended to refer to more traditional approaches of analysis presented in the international managerial literature and to accept conceptual analysis tools and interpretations proposed by studies that are still experimental. The first approach was presented by the prior literature recognizing the important role of slack resources in intangible operational activities in converting improvised creative activities of the style office and the engineering activities of fashion collections into enhanced innovation capability. In the most recent interpretations resource slack manifests itself in the context of improvisation by helping the firm to interrupt a dysfunctional momentum and work out innovative solutions (Johannessen et al., 2015; Saemundsson and Candi, 2017; Lin, 2018).

Factors including rapid technological development, the advent of innovative processes openness that involve sub-sectors belonging to diversified supply chains (especially at the 'supply-side' level), shorter product life cycles, more

diversified and customized demand and fierce marketing competition make today's way of doing business increasingly unpredictable and risky.

From the reflections that emerge as a result of the knowledge acquired on the methods of comparing the firms of the sample, it emerges that some firms develop effective supply chain risk management (SCRM) strategies in response to the uncertainty of competitive challenges, such as dynamic pricing (because of the life cycle of the technology incorporated in the products and of the customized engineering activities for each order), product-portfolio assortments, multi-sourcing strategies, vendor managed inventory.

A multi-criteria decision is defined as a process in which multiple conflicting criteria have to be considered to evaluate different options, resulting in varying decision outcomes. Interestingly, there are many conflicting criteria in the decisions of a firm's supply chain, including the supplier's selection factors and supplier's performance criteria with respect to cost, quality, delivery time (Amid et al., 2011).

These procedures must be those that allow them to maintain the competitive differential vis-à-vis various competitors at least on the critical success factors, such as product differentiation, the ability to manage complex order cycles, the efficient use and on a small scale of new process technologies, the use of new materials, etc.

As hypothesized in hypothesis number 1, we know, paradoxically, the innovative situations of firms characterized by this gap. These are destined to be more predictably successful. The hypothesis also seems to have been verified; in the improvement of the technical-functional characteristics of the creative product offered, and the ability to efficiently redesign innovative production processes. As far as hypothesis 2 is concerned, figure 1 can help us to understand some characteristics concerning the ability to efficiently redesign innovative production processes in an operative context of supply chain strongly integrated in the disruptive innovative openness phenomena.



Figure 1: Radar of the variables shown in table 1. Source: elaboration on empirical investigation

The analysis of the figure shows, first, that the sample of firms presents multiple aspects of homogeneity about many of the variables examined and reported in table 1. In particular and following the field survey, the firms were attributed a high evaluation on relations with suppliers (i.e., variables); positive results have been achieved by almost all the firms investigated following the business process reengineering of production systems (a); very high were the values recorded on the growth of internal know-how (f) and on profitability (e). It emerges that they did not consider important the competitive challenge based solely on cost reduction (b. Input costs-based challenges).

Therefore, the relevance of the skills that the companies of this fashion sub-sector have seems confirmed, especially those embedded in the processes of the investigated companies. The latter have matured in R&D activities applied to production systems. We wanted to hypothesize (Hypothesis 3) that skills and resources in the production-manufacturing sector are important for knitwear firms, in addition to those related to marketing, in the current innovative processes of dynamic, and in this sense flexible, supply chains. Moreover, innovation needs manufacturing: this activity area generates a profitable link between procurement and operations.

## 5 Some concluding observations

During the empirical investigation it emerged that perceived competitive uncertainty is the primary and critical driver of supply chain innovative processes flexibility even in companies belonging to a sector, that of knitwear, belonging to the super luxury Italian fashion system.

The relational theory currently appears to be the most suitable for the understanding of the value creation phenomenon in modern supply chains and more precisely for the interpretation of the 'supply side' relationships that characterize innovative (innovative in the sense of unconventional) new product development processes (NPD) and sometimes experimental innovative processes that radically modify entire production chains or significant parts of them. It is not so much the value of the supply that is of interest as much as the value generated by the relationship between the purchasing company and the supplier: the traditional view of the supply relationship maintained to support it or help it to increase its knowledge loses its relevance. On the contrary, the supplier is unknown, not easily assessable following the usual rating (vendor rating) and selection practices, operating in experimental technological domains.

The study analyses the benefits that the redesigned production processes generate in an innovative sense, in particular the improvement of the technical-functional characteristics of the creative product offered, and the ability to efficiently redesign innovative production processes. We wanted to investigate whether product innovations and process innovations are effective by virtue of the technical operational knowledge in procedures that allow the effective implementation of external technologies. We focused on the need for companies to redesign supply chain relationships on the supply side, both with current suppliers and with new members of other supply chains. It was found that the productive knowledge possessed by all the productive enterprises of a company is the basis of the ability to identify and implement radically new technologies, until recently used in the Italian clothing fashion and in the Italian knitwear fashion. These abilities are in practice the prerequisite for successfully engineering new production processes, in addition to the traditional ones: the innovative and traditional production processes, both maintain the peculiarity of generating creative products perceived as almost artisanal.

Finally, it emerges that for the examined Italian fashion system sector, that of knitwear, in the operation area, by virtue of the capital-intensive phase of weaving, a knowledge system is established which makes use of a manufactured-based R&D activity. It is found that both the embedded knowledge system in the operation area and the applied research activities are the basis of the ability of non-large creative companies to prefer open innovative phenomena that are radically new.

The research provides important contributions both to strategic management and to the innovation literature, especially when the author considers the role of the resources of specific operating systems of companies in guiding the innovation of the company based on production. Our findings reveal that the impact of buyer-supplier fit on supply chain performance increase when firms operate in dynamic environments. In practice, the success of innovative processes requires motivation to innovate and skills in innovation management as well as the availability of relevant financial, human, productive, creative resources that can aid innovation. The improvement of the economic aspects deriving from the management of operations, from the ability to engineering technological inflows radically, from the ability to redesign new supply chain relationships 'supply side' and even to build new relationships with suppliers belonging to other new supply chains show that relationships between economic actors are evolved. This allows us to re-read in a new way the current and advanced forms of outsourcing in the areas of research and development and the outsourcing of competitive business performance through cooperative relationships with suppliers (product co-development with innovative technical yarns).

The focus of the study of Italian fashion luxury knitwear firms has allowed us to develop innovative and creative processes, as these analogous sequences: innovation process in this framework, with the decision to innovate and advances through stages of investment in innovations, implementation and commercialization in various supply chains also strongly diversified among themselves.

In the empirical analysis it was found that operations-based objectives are important for all the investigated firms: they are manufacturing-based firms since they carry out internally and internally the entire design-engineering-production cycle ('integrated production cycle' firm).

## 5.1 Managerial implications

The research provides important contributions to both strategic management and innovation literatures especially when, the authors consider the role of firm-specific operations systems resources in driving manufacturing-based firm innovativeness.

This also explains why Italian yarn producers can direct their resources to innovation supply both in the processed materials and in the production, processes that are adopted for their industrial-buyers and that improve their ability to compete worldwide.

In the empirical analysis it was found that operations-based objectives are important for all companies and can be easily explained by the fact that the ten companies carry out the entire work cycle internally.

These findings have important managerial implications considering that the innovative supply chain processes in which a leading role is assumed by firms operating in the so-called traditional manufacturing sectors generate an increase in flexibility of the entire supply chain. The findings indicate that from a flexibility perspective, knitwear firms perform best when suppliers and buyers exceed their expectations.

## 6 Limits and future research interests

Certainly, the methodology used lends itself to limited representations, also graphic ones, given the small size of the firms studied with respect to the meticulous level of detail, and therefore to the number, of the economic-strategic variables.

One of the limitations is represented by the failure to compare the firms studied with the values expressed by the Italian knitwear industry and the Italian fashion system (knitwear, packaging, shoes).

Further research interests are represented by the fact that the change in supply chain design is due to the influence of integrative technologies (such as Big Data, IoT) and the opportunities for organization to create synergies because of the combination of 'normal' production and 'customer specific' production (additive manufacturing).

Moreover, further theoretical, and empirical development will be required to provide comparison and feedback of the findings found over time and with a more inter-sectoral and intra-business focus.

Furthermore, simulations of supply chain events, supported by technologies, allow one to create various scenarios in advance depending on future situations that result in a more efficient and effective supply chain control and the possibility to evaluate and eliminate risks before they occur.

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