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Innovative Supply Chain Practices (ISCP) in Supply Chain Management: Development and Validation of a Measurement Scale

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Abstract. Innovation is nowadays a major concern for companies seeking to improve their competitivity. Inter-organizational innovation is a lever frequently used by companies to achieve this end. In this context, businesses need to go beyond the traditional view of technological and product innovation and develop managerial innovations. In recent years the emergence of practices such as CPFR (Collaborative Planning, Forecasting and Replenishment), VMI (Vendor Managed Inventory), Kanban supplier or consignment stock, has demonstrated the managerial popularity of these types of innovations and should push researchers to study them. To study such practices, a measurement instrument is necessary. However, this instrument does not exist and the existing measurement scales are fragmented. Our research goal is to develop and validate an instrument to measure Innovative Supply Chain Practices (ISCP) in Supply Chain Management (SCM). The measurement instrument consists of three independent measurement scales: ISCP deployment conditions and context, organisation's innovation capacity, and ISCP performance. For each scale, we used a three-step methodological process: construction, purification and validation.

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Innovation is a key factor in business performance (Panayides and Venus Lun, 2010). One way to innovate is to think of one's customers, suppliers, and more generally one's partners. For the company, this refers to management of its inter-organizational relationships. Beyond the traditional view of technological and product innovation, organizations need to develop so-called "managerial" innovations. Such innovations can be an important source of competitiveness for organizations (Birkinshaw et al., 2008). Damanpour and Aravind (2012) "recommend investigation of external conditions and internal processes that facilitate the introduction of compositions of innovation types across organizational units and over time" (Damanpour and Aravind, 2012: 447). Interest in the inter-organizational dimension of innovation is even more important, as witnessed in recent years by the rise of Supply Chain Management (SCM) (Lambert et al., 1998; Chen and Paulraj, 2004a; Simatupang and Sridharan, 2005). This new logic is driving companies to consider that coordination and collaboration within their supply chain are essential in order to innovate in their practices. Indeed, collaborative management of upstream, internal and downstream partners, and their consideration in supply chain management, become a guarantee of value creation for customers (Bowersox et al., 2000). Thus, evaluating the performance of these types of innovations is a significant challenge that companies must be able to overcome to design and ensure their competitiveness and survival. In recent years the emergence of practices such as CPFR (Collaborative Planning, Forecasting and Replenishment), VMI (Vendor Managed Inventory), Kanban supplier or consignment stock, demonstrates the managerial popularity of these types of innovations and should conduct researchers to study them.

The literature on this topic, however, remains relatively restricted and fragmented (Arlbjørn et al., 2011; Soosay et al., 2008.) and some authors lament that researches in the field of logistics and SCM largely ignore the concept of innovation (Flint et al., 2005). From this perspective, the authors open the way for studying innovation in inter-organizational practices through questioning information systems (Bello et al., 2004), collaborative relationships between supply chain partners (Roy et al., 2004; Soosay et al., 2008) and expected benefits (Wagner, 2010).

While many measurement scales have been developed around innovation and SCM, relatively few have studied innovative practices in this domain. Flint et al. (2005, 2008) proposed a measurement instrument issuing from the literature to study the process of innovation in the downstream supply chain. Li et al. (2005) developed a SC practice measurement scale. Knight and Cavusgil (2004) examined the capacity in an organization for product innovation at the R&D level. More recently, Zhao et al. (2008) developed a measurement scale centred on integration of customers in innovation via questioning power and the nature of relationships. Cao and Zhang (2010) proposed a scale showing the benefits of collaboration for innovation. In the same vein, Panayides and Venus Lun (2010) studied supply chain performance, Wallenburg et al. (2010) focused on improving outsourced relationships in terms of costs and services, and Lin et al. (2010) questioned the factors affecting the deployment of innovation, including the integration of customer needs and market orientation. The numerous scales dedicated to innovation and SCM show the growing interest on the part of researchers to better understand this phenomenon. However, these studies and scales are fragmented if one is trying to study a subject as vast and complex as innovation in SCM. They are often piecemeal. In particular, they are usually limited to a single SC axis (downstream, Zhao et al., 2008), an aspect of innovation (diffusion, Hazen et al., 2012), a type of actor (logistics service providers, Busse and Wallenburg, 2011), a type of innovation (products, Knight and Cavusgil, 2004), or an industry (Taiwanese high-tech industries, Lin et al., 2010; agri-businesses, Fortuin et al., 2007). Thus, a unifying conceptual framework needs to be built. The lack of overall vision concerning SCM innovative practices and the absence of a reliable instrument to measure this phenomenon are two gaps that this research aims to fill.

Our research goal is to develop an instrument to measure Innovative Supply Chain Practices (ISCP) in Supply Chain Management (SCM). The measurement instrument consists of three independent scales. To develop and validate each of these scales, we followed the methodological approach proposed by Churchill (1979), Dunn et al. (1994), Hinkin (1998), Hensley (1999), MacKenzie et al. (2011), and recently used by Charbonnier-Voirin (2011). We used a three-step process for each of our measurement scales: construction, purification and validation.

This article is part of a larger research program on managerial innovation in the field of Supply Chain Management (Lavastre et al., 2011; Ageron et al., 2013; Lavastre et al., 2014.). In this paper, we develop and validate an ISCP measurement instrument. This one (consisting of three scales) was recently used to test and validate a conceptual model on ISCP performance factors (Lavastre et al., 2014).

THE CONCEPT OF INNOVATIVE SUPPLY CHAIN PRACTICE (ISCP) AND ASSOCIATED CONSTRUCTS

In order to build our Innovative Supply Chain Practices (ISCP) measurement scales we will define and clarify this concept. This first section positions our research in the literature on SCM practices and SCM innovation. It shows the theoretical background and the contributions of previous research. It also clarifies the different performance characteristics of ISCPs and highlights key issues related to the development of measurement scales.

INNOVATION IN SCM AND THE CONCEPT OF ISCP

Our interest in the concept of ISCP positions us at the intersection of two distinct research domains: innovation and SCM. In the following paragraphs we will present research on innovation in general and studies related to innovation in SCM, with the goal of showing the contributions of each of these fields to our research question.

Innovation from a general perspective

Van de Ven (1986) defined innovation as "a new idea, which may be a recombination of old ideas, a scheme that challenges the present order, a formula, or a unique approach which is perceived as new by the individuals involved. As long as the idea is perceived as new to the people involved, it is an "innovation", even though it may appear to others to be an "imitation" of something that exists elsewhere"(Van de Ven 1986: 591-592). Using this definition, Van de Ven highlights the fact that innovation can be either incremental (a modification or recombination of things established in the company) or radical (by introducing new things in terms of rules, the organization, the order previously established by the company). This distinction between incremental and radical has also given rise to much research (Dewar and Dutton, 1986; Damanpour, 1991; Hurley and Hult, 1998; Brettel et al., 2011; Göktan and Miles, 2011; Kelley et al., 2011).

More recently, Damanpour and Aravind (2012) recommended going beyond the very "technology-based" conception of innovation to include interest in managerial innovations. They define them as "new organizational structures, administrative systems, management practices and techniques that could create value for the organization" (Birkinshaw et al., 2008: 825). These innovations have received little research attention thus far, yet they represent a continuous source of performance for companies (Leroy et al., 2013). Using this perspective, Damanpour and Aravind (2012) suggested some research avenues to study this type of innovation and recommend, for example, examining the external and internal conditions that facilitate innovations, particularly in inter-organizational relationships. This recommendation echoes the growth of Supply Chain Management in recent years. This particular inter-organizational context, characterized by a need to coordinate the flow of information and materials between several organizations, seems all the more important given that most of the observed innovations are managerial (Li et al., 2005; Ageron et al., 2013).

Innovation in SCM

SCM has developed in businesses, and is today one of their major concerns. Simultaneously, an extensive body of literature has emerged to capture SCM characteristics and developments. (Lambert et al., 1998; Chen and Paulraj, 2004a; Chen and Paulraj, 2004b; Simatupang and Sridharan, 2005; Zhao et al., 2008). The inter-organizational perspective of SCM assumes that firms are dependent on each other and are embedded in business networks where the borders of companies move to integrate all upstream and downstream partners. This integration is part of collaborative alliance or integration strategies that develop between the members of a same supply chain (Simatupang and Sridharan, 2005). In this context, management of inter-organizational

relationships between partners is a key component of SCM. Innovation in Supply Chain Management remains, however, marginally investigated. To your knowledge, a single literature review exists on this subject, that written by Arlbjørn et al. (2011). A search performed using EBSCO Host Research Database (business search first) with the keywords "supply chain innovation" and "logistics innovation" finds only 29 articles addressing this type of innovation. Certain authors have studied innovation in the SC by questioning new technologies. Holmström (1998) focused on an inter-organizational practice, VMI (Vendor Managed Inventory), and showed that this innovation introduced changes in the organization (new job creation) and allowed the company behind the innovation to create service for its customers and gain competitive advantage. Bello et al. (2004) examined technological innovations between foreign partners. Retaining an institutionalist approach, they posed the problem of context and showed that regulations, standards, and the different partners' cultures impact innovation. To innovate in different institutional contexts, companies must foster cooperation, specifying the distribution of earnings between the partners to secure and guarantee a payback based on the sums put forward, even if the question of the difficulty for companies to assess the ROI (Return on Investments) remains, both financially and over time. Roy et al. (2004) were interested by customer-supplier inter-organizational relationships in supply chains and in the generation of incremental and radical innovations. They showed that two main categories of factors influence innovations in SC: factors internal to the inter-firm relationship (commitment, adoption of inter-organizational information systems, confidence) and factors external to the inter-firm relationship (stable demand, wireless networks). Soosay et al. (2008) studied how collaborative relationships encourage continual innovation in the supply chain. Using a qualitative approach, they showed that these collective behaviors may involve shared planning, knowledge and logistical process sharing, or joint investments.

Some companies go so far as to accompany and support their partners in innovation when they lack the means, resources, or when they encounter difficulties. This collaboration, through the sharing and accumulation of knowledge and the information it generates, must allow all the companies to build an innovative capacity, even if the assessment and sharing of gains are difficult. Flint et al. (2005, 2008) also discussed the innovation process in the SC. Based on the observation that research in SC largely ignores the concept of innovation, they proposed studying innovation as a unit of analysis in the context of SCM. They showed that innovation presupposes a real corporate commitment to innovation, anticipation of customer needs, the ability of firms to identify their expectations, and finally, intra- and inter-organizational learnings.

The concept of ISCP and core issues

Many Supply Chain Management practices (CPFR, VMI, etc.) have developed in companies. Meanwhile, a growing number of companies are innovating in their Supply Chain Management (SCM) to improve competitiveness and to satisfy their customers. A 2005 OECD report highlighted the need to study organizational innovations for two main reasons. On the one hand, they often accompany product and / or technology innovations. On the other hand, they are better able to create a competitive advantage that is durable, easily defensible, or difficult to imitate by competitors (Damanpour and Aravind, 2012; Leroy et al., 2013). The OECD report (2005) therefore recommended conducting research to characterize this type of innovation, but also to assess its economic impact on businesses. We subscribe to this view and propose completing knowledge in the field of innovation by questioning ISCPs in the domain of SCM.

We define innovative supply chain practices (ISCP) as the development and implementation of tools and methodologies by and between partners of the

same supply chain, that do not previously exist within the company or its subsidiaries, and which aim to address a variety of issues related to quality, cost and timeliness (Lavastre et al., 2011). These practices are generally part of a policy of continuous improvement and value creation for the customer, and increased company and entire supply chain performance (Lavastre et al., 2014).

The literature review conducted for this study focused on the concept of innovation, and more particularly, applied to the field of SCM innovation. In associated with our qualitative research phase (the methodology is presented and detailed in Section 3), this review indicates three important issues: the deployment context and conditions of the innovation, the innovation capacity of the organization deploying the ISCP, and ISCP performance.

The deployment context of an ISCP is essential. Indeed, unlike an invention which refers to the creation of something new, innovation is the economic and financial translation of an invention. It therefore requires a transformation and appropriation by the company that must include the innovation in its organization and strategy, and match market expectations (Lin et al., 2010; Zhao et al., 2008). As emphasized by Garcia and Calantone (2002) "it is important to elucidate that an invention does not become an innovation until it has processed through production and marketing tasks and is diffused into the marketplace" (Garcia and Calantone, 2002: 112). Any innovation is relative to the context in which it is designed and deployed (Becheikh et al., 2006).

The innovative capacity of the organization deploying an ISCP is the translation of their "ability […] to adopt or implement new ideas, processes, or products successfully" (Hurley and Hult, 1998: 44). This capability, which reflects the companies' innovation orientation or "approach", is based on a set of organizational skills that produce innovations of all sorts (Siguaw et al., 2006). It is therefore necessary for all businesses to ask themselves the critical question concerning their capacity for innovation.

Evaluation of an innovations' performance is important for businesses (Wagner, 2010) because it affects their decision to commit. If firms have effectively identified quantitative criteria in the area of product innovation (sales, patents, etc.) (Zhou and Wu, 2010), things are different with respect to innovation practice. The performance of this type of innovation is difficult to mesure because the criteria are often qualitative, such as knowledge management that is assessed by the generation of ideas, implicit and explicit knowledge management and the flow of exchanged information (Adams et al., 2006). Even the use of quantitative performance criteria (such as return on investment and the distribution of earnings between partners) can be challenging, given the inter-organizational nature of the innovation (Faems et al., 2005; Lin et al., 2010).

If these aspects appear to be critical to the outcome of our qualitative phase and review of the literature, they do not begin to cover all the ISCP performance characteristics. Indeed, other factors may appear important: maturity (McCormack et al., 2008), the industry (Becheikh et al., 2006), the organizational structure (Damanpour, 1991), or the innovation culture (Hurley and Hull, 1998). These other factors do not, however, emerge from our interviews with experts, performed during the qualitative phase. Following the methodological guidelines for development and validation of measurement scales (Churchill, 1979; Dunn et al., 1994; Hinkin, 1998; Hensley, 1999; MacKenzie et al., 2011) these factors (despite their theoretical interest) have not been included in our measurement scales.

THE CONSTRUCTS

Based on our (exploratory and confirmatory) qualitative and quantitative phases, it was found that each of the three constructs is based on several dimensions. Thus, the context and conditions of deployment consist of the

innovative process, expected gains, collaboration, and the environment in which the ISCP is deployed. The organization's innovative capacity improves thanks to the existence of an internal project structure and a joint project structure with the ISCP partner(s) and expertise and experience. Finally, the performance of ISCPs refers to the match between the extent of the success, knowledge creation and expectations.

The ISCP deployment conditions and context

Some authors have studied the conditions and context of deploying an ISCP. They show that firms innovate under pressure from competitors and public authorities (Yalabik and Fairlchild, 2011), through their network and their industrial partners (Ragatz et al., 1997), depending upon their market orientation (Lin et al., 2010), and through the acquisition of new technologies (Becheikh et al., 2006).

The innovative process. To be effective, innovation must be part of the company strategy. Some organizations clarify and formalize their commitment to innovation through a deliberate and conscious strategy (Adams et al., 2006). Others seem to innovate under difficulties and with great effort (Wynstra et al., 2010). To understand this process, several explanatory factors have been highlighted. Commitment and support from management are frequently cited (Goodale et al., 2011), as resources (financial, material and human) allocated to innovation (Cooper et al., 2007), and the culture, including the attitude vis-à-vis risk, change and failure (Yang, 2012). Suppliers customers and competitors are identified as external factors constraining innovation by industry partners (Wynstra et al., 2010). Identification of a typical innovation strategy remains, none the less, difficult to achieve for companies. To the extent that they are engaged in inter-organizational relationships, innovations may be equally voluntary and constraining, making it difficult to identify the source of innovation.

Expected gains. Because innovations often require extensive financial and organizational investment (Fortuin et al., 2007), many companies are reluctant to engage in such projects. The ability to assess the expected benefits is an important step in innovation. However, quantifying these gains is difficult, partly because companies must evaluate the benefits before the choice to innovate has been made. Companies or partners' experience in previous innovative projects can help in assessing these gains (Becheikh et al., 2006; Echtelt Van et al., 2008). The expected return on investment of each partner should also be agreed upon prior to starting an innovative project. This agreement allows everyone to clarify their expectations regarding the expected future earnings and thus build a shared vision. Companies also mention that the success of their innovations depends on the degree of involvement and commitment from their innovation partners (Kim, 2000). Finally, the distance between a company and the market can also render estimating expected gains difficult, when companies do not carry the innovative project. Relative transparency on the part of the partner is essential so that everyone can equally benefit from the project (Faems et al., 2005; Lin et al., 2010).

While many researchers and practitioners put forth the importance of financial gain (and more precisely the payback period) in assessing an innovation (Oh et al., 2012), the financial dimension alone is not sufficient for making an evaluation (Beamon, 1999). It is therefore necessary to take into account and to incorporate other dimensions such as brand awareness, quality, and market position, (Shin et al., 2000; Tan et al., 2002). However, these elements are difficult to estimate a priori because they are an indirect result of the innovation (e.g. reputation and experience). Despite this, the company can put these elements to use in future innovative projects. They also take longer to emerge, because they are not always visible and perceived by the company. Thus, the

horizon for anticipated returns must also be considered when making the estimation. Traditionally, companies classify their earnings in the short-term, medium-term and long-term.

Collaboration. Today, many companies have established collaborative networks with partners to reinforce their competitiveness. The success of inter-organizational innovations depends on the ability of firms to mobilize their partners in a profitable way (Pohle and Chapman, 2006). Collaboration between partners must therefore allow companies to increase the value provided to customers while respecting cost and time constraints (Zhao et al., 2008). In this way, collaboration positively impacts innovation, insofar as companies that do not internally possess the resources and expertise to innovate, will seek them from their partners (Cao and Zhang, 2011). Organizational boundaries move to provide a supportive and positive environment for innovation. Companies should build their inter-organizational networks intelligently in order to provide strategic resources for their innovations, but also to benefit from subsequent gains stemming from the supply chain (Pohle and Chapman, 2006). The strategic partners chosen by companies for their innovative practices are often customers and / or suppliers with whom they have established, long-term relationships and where trust is essential. It should also be noted that the intensity of exchanges and communication enhance the development of inter-organizational networks, as they reinforce collaboration by increasing customer satisfaction and the company's competitiveness (Donney and Cannon, 1997; Kwon and Suh, 2005).

The Environment. The environment also seems to play a significant role in innovation. In this regard, Tidd (1995, 2001) emphasized that environmental uncertainty and complexity have a significant influence on business innovation. The innovation strategy of firms can be affected by an overly turbulent environment (Zhou, 2006; Naranjo-Valencia et al., 2011). To this end, Göktan and Miles (2011) showed that companies need to acquire and develop ways to innovate in order to cope with unstable demand and a dynamic context. These resources can be obtained internally, but also through external customers and suppliers. Damanpour and Gopalakrishnan (1998) emphasized the need for future research that will incorporate additional variables related to the business environment. Stemming from a study of 21 innovation projects, Damanpour (1996) concluded that "environmental uncertainty influences both the magnitude and the nature of innovation [...] [and] future research should attempt to adopt environmentally sensitive theory of organisational innovation" (Damanpour, 1996 p.710-711). Environmental uncertainty is evaluated depending upon the extent and variety of its complexity and the frequency and predictability of its instability.

The organization's innovative capacity

Innovative capacity refers to the ability of an organization to engage in innovation (Panayides, 2006), namely, its ability to turn ideas and knowledge into products, processes or systems (Lawson and Samson, 2001). It is based on a combination of factors recognized as essential including people, tools and methods, physical and financial resources (Adams et al., 2006).

The internal project structure. Regarding the actors involved in innovation, it is important to take into acount of the personal characteristics of the individuals and of the organization's internal project team. In this regard, Damanpour (1991) showed that the diversity of experiences and skills of those involved in innovation are an extremely favorable lever for innovation. For businesses, getting individuals or different services to work together allows them to take advantage of existing complementary skills and knowledge. Innovative projects are thus often assigned to cross-functional teams including, for example, R&D, marketing, and

purchasing (O'Connor and McDermott, 2004; Lin and Ho, 2008). This cross-functionality leads companies to set up multi-dimensional organizational structures, typically project teams, to drive innovation (Brettel et al., 2011). Several factors can explain the importance of implementation of these internal teams. First and foremost, they give the company a broader vision and understanding of innovation. Indeed, unless the members of the project team possess a wide range of skills, it is probable that innovation is mainly based on the expertise of the team members, without integrating other alternatives. However, it is important to expand the team and integrate people whose skills are not only professional, but also related to interpersonal skills or know-how. A second reason for establishing an internal project team is the fact that these structures enhance and boost exchanges and communication between members of the same company. Hurley and Hult (1998) showed that communication and the exchange of information have a strong impact on innovation. Finally, it should be noted that project teams are important during the design phase of innovation, but they are also vital in the implementation phase, particularly because they serve as a necessary change management that is often essential to innovation success (Brettel et al., 2011).

The joint project structure. The increasingly turbulent and complex environment is pushing companies to go beyond their limits for innovation based on their own resources and internal expertise, and encourages them to develop joint project teams with their partners. Today, innovations increasingly exceed the confines of the company's boundaries, and are reliant on networks or alliances developed with customers, suppliers or other partners (Von Hippel, 1988; Musiolik and Markard, 2011). Companies look to their partners as innovation sources that are not always internal, but that help them seize new opportunities and increase their performance. The growing importance of partners in innovation confronts companies with new concerns, namely coordination. Indeed, increased geographical and cultural distances complicate the exchange of information and communication which are essential to innovation success (Donney and Cannon, 1997; Suh and Kwon, 2005). While the development of new information and communication technologies (ICT) can reduce these distances, Petersen et al. (2005) stressed the importance of setting up a joint project team, especially because these teams must be able to make better decisions faster, to set more realistic goals and work more collectively and harmoniously. Musiolik and Markard (2011) reached the same conclusion, that a joint structure creates favorable conditions for innovation, in particular, by dedicating specific resources. Creation of a joint structure also allows distribution of the roles, responsibilities and authority of each individual in the project (Stewart and Barrick, 2000). It also helps and encourages customers to allocate more resources, including human resources, to the innovation project (Lettice et al., 2010). However, establishment of a joint team raises a problem concerning distribution of the gains created by the innovation. In this regard, even if suppliers recognize the need to play the game on behalf of their clients, they also raise the point that the benefits of innovation are not always distributed equally (Lin et al., 2010).

Experience and expertise. The third important factor is the experience and expertise of the company in innovation, and importantly, the attitude of businesses vis-à-vis the risk of failure and change. Indeed, innovation presupposes that companies will be bold in their choices and dare to do things for which success is not always guaranteed. The experience and expertise they have developed through other innovative projects are critical factors for the success of an innovation (Adams et al., 2006). In this regard, O'Connor and McDermott (2004) stressed the importance of continuity in innovative projects but also between innovative projects, and particularly as regards the project team.

Indeed, the accumulated experience of people who regularly participate in advancing innovative projects is a source of expertise in innovative project management. With their experience and the expertise they have developed, the project team members have the capacity to implement the best practices necessary for successful innovation and to optimally use materials and tools dedicated to innovation (Cooper et al., 2007). But companies seem not to be aware of the critical importance of combining this experience and expertise that plays a role in the relationships established between the partners and influences the transparency necessary for any innovative project (Fawcett et al., 2008). Similarly, the ability of project managers to influence project decisions, particularly through their inter-personal networks, is a key performance factor for innovation (Chollet et al., 2012). Even if the innovation partners are aware of this need for transparency in the success of innovation, they are still faced with concerns of exposing their secrets and weaknesses to other enterprises (Fawcett et al., 2008). This relative inability to open up to others, however, seems to diminish or even disappear when partners, because of their shared experiences, have built a trusting relationship.

ISCP performance

Finally, evaluation of ISCP performance remains an important element in the decision to innovate. The performance indicators for product innovation are numerous and have been extensively studied. One can cite, for example, the number of patents issued or increased sales following the introduction of new products (Zhou and Wu, 2010). If performance indicators in SCM innovation are different because they are more qualitative (flexibility, responsiveness, quality), they are none the less essential (Beamon, 1999; Gunasekaran et al., 2004; Panayides and Venus Lun, 2010). Performance evaluation of this type of innovation is complicated (Damanpour and Aravind, 2012) and is dependent upon the actors' perceptions (Adams et al., 2006).

The extent of success. Overall supply chain performance is associated with innovation performance (Panayides and Venus Lun, 2010). The question that remains unresolved is the scope of success. Inter-organizational performance in innovation must involve all stakeholders (customers, suppliers, distributors or service providers) and can be based on technical, organizational and collaborative aspects. Knowledge developed and acquired during various inter-organizational innovations can be capitalized upon and engaged in other projects. In doing so, the company creates innovative capabilities that when used later, will achieve greater organizational performance (Van Echtelt et al., 2008). Faems et al. (2005) showed that inter-organizational collaboration has a positive impact on the company by increasing its capacity for innovation and performance. Inter-organizational collaboration also impacts innovation performance throughout the entire SC. The extent of success in the supply chain, however, remains subtle and variable, depending upon the partner involved in innovation, as highlighted by Faems et al. (2005). For example, the innovative capacity of a supplier seems to have a much greater impact than innovative customer inter-organizational practices (Azadegan and Dooley, 2010; Wynstra et al., 2010). Furthermore, if innovation is to benefit all involved, it seems essential that these innovations be visible and be perceived as beneficial by customers, because of the increased advantage provided when compared with previous practices (Rogers, 2003; Skipper et al., 2009).

Knowledge creation. Knowledge creation has been widely discussed in the innovation literature. Different theoretical perspectives have been mobilized including resource theory (Wernfelt, 1984). This theory assumes that the resources of a company, whether tangible or intangible, significantly condition its

position vis-à-vis other companies and provide an advantage. Based on this observation, Hult et al. (2004, 2006) expanded the scope of analysis and became interested in the creation of knowledge in the supply chain. In particular, they showed that knowledge is an important strategic resource if each company in the supply chain "[…] continuously builds its usable knowledge to develop a foundation for its competitive edge" (Hult et al., 2006: 460). Craighead et al. (2009) proposed studying this capacity to create knowledge through three constructs: the accumulation of knowledge, the use of existing knowledge and organizational memory. Knowledge accumulation refers to the ability of a company or a supply chain to continually increase its knowledge base. This knowledge allows for problem solving or improving situations by its use or reuse. The use of existing knowledge is the second important part of this particular ability, because it helps and accompanies the company in its choices and decisions. Finally, organizational memory must be a strong element of this capability, especially because it assumes that knowledge is stored regularly and is available to the entire company. Inter-organizational memory is difficult to implement, however, even if it is an essential tool in a SC's ability to create new knowledge (Blome et al., 2014). In conclusion, it is important to note that the creation of knowledge is not limited to one company, but involves all supply chain partners.

Matching Expectations. The performance of an ISCP must also be evaluated in terms of its relevance to the expectations of the company and its innovation partners (Goodale et al., 2011). Many studies have attempted to evaluate the performance criteria of an innovation. Most performance criteria have focused on products, including the number of patents filed, or increased sales following the introduction of new products (Zheng et al., 2010). In the context of SCM, it seems that innovation must be assessed using other criteria. Among the traditional criteria, cost, quality, flexibility and delays are frequently mentioned. Regarding the financial aspect, innovating companies seek to create value (with sales growth and gross margin, Song and Di Benedetto, 2008) while simultaneously trying to reduce and control associated costs (stock or product quality, Kim et al., 2012). The resulting reduced costs or increased profits benefit the company as well as the whole supply chain. Innovation thus helps a company maintain a competitive advantage over its competitors and is a source of long-term performance. Using this perspective, Van Echtelt et al. (2008) showed that the ability of an organization to create value through innovation is an important factor in engaging suppliers. Finally, the satisfaction of company management is an important element in evaluating innovation performance. Matching the expectations of the company in terms of gains remains a strong element in evaluating the success of an ISCP. Although the criteria of cost, quality and time are the most frequently cited, it has also been observed that innovation must additionally be assessed in terms of the competitive advantage it creates. An innovation will be all the more beneficial if it is visible to the entire supply chain and creates a competitive advantage (2003 Rogers; Skipper et al., 2009).

SYNTHESIS OF THE LITERATURE REVIEW

A summary of our theoretical background is presented in Table 1, with a brief definition of each construct and its related theoretical underpinnings.

Table 1. Synthesis of the literature review

Construct and dimension	Definition	Associated literature
ISCP deployment conditions and context	Conditions, constraints and motivations that encourage firms to innovate.	Ragatz et al., 1997; Becheikh et al., 2006 ; Lin et al., 2010 ; Yalabik and Fairchild, 2011.
Innovative process	How the company innovates, either deliberately and voluntarily, or emergently and imposed.	Adams et al., 2006 ; Cooper et al., 2007 ; Wynstra et al., 2010 ; Goodale et al., 2011 ; Yang, 2012.
Expected gains	Assessment of expected earnings and return on investment from innovation.	Beamon, 1999 ; Kim, 2000 ; Shin et al., 2000 ; Tan et al., 2002 ; Faems et al., 2005 ; Becheikh et al., 2006 ; Fortuin et al., 2007 ; Van Echtelt et al., 2008 ; Lin et al., 2010 ; Oh et al., 2012.
Collaboration	Ability of firms to mobilize their partners for innovation and the types of partners involved.	Donney and Cannon, 1997; Kwon and Suh, 2005 ; Pohle and Chapman, 2006 ; Zhao et al., 2008 ; Cao and Zhang, 2011.
Environment	Complexity and instability of the environment in which firms innovate.	Tidd, 1995 ; Damanpour, 1996 ; Damanpour and Gopalakrishnan, 1998 ; Tidd, 2001 ; Zhou, 2006 ; Goktan and Miles, 2011 ; Naranjo-Valencia et al., 2011.
Organisation's innovative capacity	Ability of firms to engage in innovation, that is to say, to turn ideas and knowledge into products, processes or systems.	Lawson and Samson, 2001 ; Adams et al., 2006 ; Panayides, 2006.
Internal project structure	Internal structure within the organization, responsible for designing and deploying innovation.	Damanpour, 1991 ; Hurley and Hult, 1998 ; O'Connor and McDermott, 2004 ; Lin and Ho., 2008 ; Brettel et al., 2011.
Joint project structure	Joint structure among partners to design and deploy innovation.	Von Hippel, 1988 ; Donney and Cannon, 1997 ; Steward and Barrick, 2000 ; Kwon and Suh, 2005 ; Petersen et al., 2005 ; Lettice et al., 2010 ; Lin et al., 2010 ; Musiolik and Markard, 2011.
Expertise and experience	Capability and ease of organizations to deploy innovations.	O'Connor and McDermott, 2004 ; Adams et al., 2006 ; Cooper et al., 2007 ; Fawcett et al., 2008 ; Chollet et al., 2012.
ISCP performance	Creation of value for all parties involved in innovation.	Beamon, 1999 ; Gunasekaran et al., 2004 ; Panayides and Venus Lun, 2010 ; Zhou and Wu, 2010.
Extent of the success	Perimeter of the performance generated by innovation. Relates to a single organization or all involved partners.	Rogers, 2003 ; Faems et al., 2005 ; Van Echtelt et al., 2008 ; Skipper et al., 2009 ; Azadegan and Dooley, 2010 ; Panayides and Venus Lun, 2010 ; Wynstra et al., 2010.
Knowledge creation	The ability of companies to continually create, use and store knowledge.	Wernfelt, 1984 ; Hult et al., 2004 ; Hult et al., 2006 ; Craighead et al., 2009 ; Blome et al., 2014.
Matching expectations	Meeting the expectations of stakeholders (internal or external to the organization) involved in innovation.	Rogers, 2003 ; Song and Di Benedetto, 2008 ; Van Echtelt et al., 2008 ; Skipper et al., 2009 ; Zheng et al., 2010 ; Goodale et al., 2011 ; Kim et al., 2012.

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RESEARCH METHODOLOGY

The aim of our research is to better understand managerial innovation in the field of Supply Chain Management (SCM) through the concept of ISCP (Innovative Supply Chain Practices). We conducted a research program that was structured in two phases: (1) the development and validation of an ISCP measurement instrument (the subject of this article) and (2) the test and validation of a research model of ISCP performance factors (which was the subject of a recent publication, see Lavastre et al., 2014).

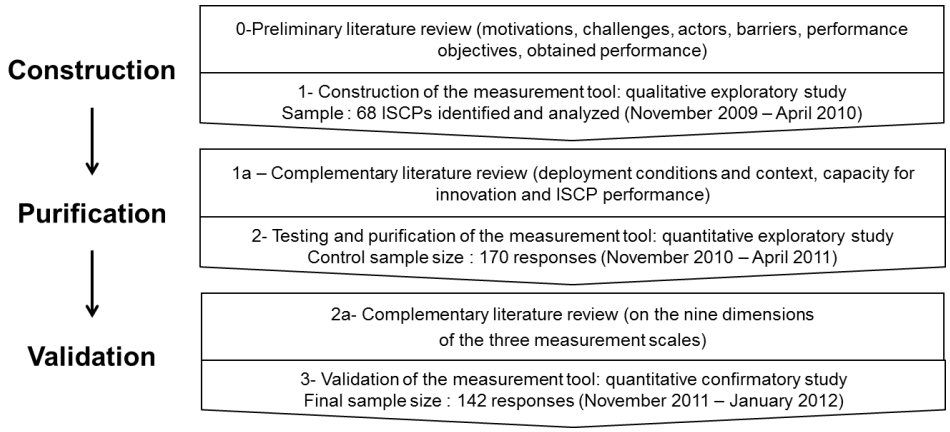
METHODOLOGY

Specific methodologies to develop and validate measurement scales have been proposed in varying fields. These include Churchill (1979) in marketing, Dunn et al. (1994) in logistics, Hinkin (1998) in organizational behavior, Hensley (1999) in operations management, and MacKenzie et al. (2011) in information systems. These are the methodologies which we have employed to perform our research. Each of these authors presented a methodological process adapted to the studied object, built around different stages (Churchill, 1979: 66; Dunn et al., 1994: 156; Hinkin, 1998: 106; Hensley, 1999: 355; MacKenzie et al., 2011: 297) that can be divided into three phases.

1. Construction of the scale (definition of the construct and generation of items).
2. Purification of the scale (selection and validation of items).
3. Validation of the scale (assessment of the reliability and validity of the scale).

These three steps are, as noted by Dunn et al. (1994), "iterative, as well as, sequential" (Dunn et al., 1994: 155). Figure 1 presents the methodology used to develop and validate our scales.

Figure 1. Development process and validation of the three measurement scales



Our research approach was deployed in three stages over three years, with three different samples.

The first step consisted of construction of the measurement scales. A qualitative study was conducted by semi-structured face-to-face interviews to better understand the concept of innovative inter-organizational practices in the area of SCM and to identify a coherent set of items. In order to gain an initial understanding of innovation, we conducted a first review of the literature that helped us identify and define the themes upon which our interviews should be based. Issuing from the field of SCM and innovation, they relate to the motivations, challenges (strategic intent), actors, barriers, performance objectives and achieved performance. From this work, an interview guide was constructed and interviews were conducted. Thanks to these interviews and their coding,

several items emerged, forming three constructs: the conditions and the context in which SCM inter-organizational innovations are deployed, the innovative capacity of an organization participating in innovation, and ISCP performance.
To prepare for the second phase of our methodological approach, we conducted a literature review on these three constructs to better identify and understand them, to localize them in past and current research, and to clarify certain items that emerged during interviews. As highlighted by Menor and Roth (2007, p.830) "good measurement is a prerequisite for good empirical science; however, multi-item measurement and scale development must be preceded by sound conceptual development of the theoretically important construct(s) being defined." Once the items had been generated, the interviews were performed and coded. These results were then reworked until a consensus emerged among the researchers. An initial questionnaire was pre-tested with five supply chain managers (working in industrial companies in the Rhône-Alps Region of France) to check the understanding of the questions. This work allowed us to clarify some questions (namely concerning the type of partners with which ISCPs are deployed), or reformulate them (as with the questions about ISCP performance), so they would be understood by all stakeholders in the innovation process and in all types of businesses.

As a result of the qualitative phase and reviews of the literature, we were able to structure our initial exploratory quantitative survey. This allowed us to test and purify our measurement instrument by administering it as a questionnaire to a control sample. The factor structure, reliability, and validity of each scale were tested. After this phase, a return to the literature was essential for two reasons. First, we needed to better identify, understand and discuss each of the nine dimensions (expected gains, extent of success, etc.) identified in the previous step. Second, revisiting the literature was necessary to better understand and justify why certain items were not retained by the exploratory quantitative statistical analysis, even though they came from the empirical findings (the qualitative analysis).

Once the scales were tested and purified, and strengthened by a substantial theoretical background, a second quantitative study was conducted. Its goal was confirmatory, in order to validate our measurement instrument. Using the tested and purified scales resulting from the previous step, a questionnaire was administered to a final sample that was independent of the previous control sample. In the end, over the three year span of the research project, nearly 380 ISCP participants were interviewed to understand and measure these innovations. The following sections will detail the three stages of our process development and validation of the measurement scales.

THE QUALITATIVE STUDY

The first step in the development and validation of a measurement scale is to specify the content of the concept being studied. Our research focuses on ISCPs and offers three constructs for studying the subject. If constructs are abstract theoretical formulations relating to the phenomenon being studied, concepts are, on the other hand, more generic and less specific; they allow one to understand the necessary aspects of the description or explanation of the phenomenon being studied. Gioia et al. (2013) highlighted this as follows: "for organization study to fulfil its potential for description, explanation, and prescription, it is first necessary to discover relevant concepts for the purpose of theory building that can guide the creation and validation of constructs" (Gioia et al., 2013: 16).

To generate a battery of items to measure the variables, fifty qualitative interviews were conducted between November 2009 and April 2010, with leaders and functional managers who had played roles in the inter-organizational

innovation processes under study. The characteristics of the respondents and their companies are presented in Table 2. These interviews gave us access to information concerning 68 ISCPs for analysis (some respondents presented two ISCPs during the interview).

Because we aim to have a comprehensive and non-limited representation, we did not focus on specific characteristics of the companies, or on an industry or type of business (especially in terms of size or structure). In this qualitative phase, "the variety of interviews is an important element when interviews are used to generate items, based on which the researcher later in his research, will collect data using a questionnaire" (Romelaer, 2005, p 107).

Table 2. Summary of data collection for the qualitative phase

Collection date : Nov. 2009-April 2010	
Type of collection : semi-directive interview	
Number of respondents	50
Number of ISCPs studied	68
Respondent function	**Percentage**
Supply Chain Manager	57%
Head of industrial management	15%
Buyer/Supplier	13%
Director	9%
Information systems Director	3%
Commercial	3%

Activity sector	Percentage
Pharmaceutical	25%
Automobile	25%
Production and distribution of gas and electricity	22%
Microelectronic and electronic	13%
Distribution	7%
Other (construction, agri-business, logistics provider…)	8%
Company size	**Percentage**
Greater than 1000 employees	41%
Between 251 and 999 employees	37%
Fewer than 250 employees	22%

In our chosen methodological framework, the aim of this qualitative phase is to generate a set of items designed to answer our research question and characterizing ISCPs via their performance. Examination of the literature led us to develop an interview guide structured around six principle generic themes that we identified and adapted to the ISCP subject in the field of SCM. These themes are: motivations, challenges, actors, barriers, performance objectives and performance obtained by the ISCP (Table 3).

Table 3. Themes, definitions and authors mobilized

Theme	Definition of the theme	Authors mobilized
Motivations	Reasons why an organization choses to develop an ISCP.	Becheikh et al., 2006 ; Robson and Haigh, 2008 ; Yalabik and Fairchild, 2011 ; Panayides and Vénus Lun, 2010.
Challenges	Situation and conditions under which the ISCP is deployed.	Ragatz et al., 1997 ; Becheikh et al., 2006 ; Lin et al., 2010 ; Yalabik and Fairchild, 2011.
Actors	Persons, services and organizations involved in the design and deployment of the ISCP.	Pohle and Chapman, 2006 ; Wynstra et al., 2010.
Barriers	Difficulties and obstacles that businesses face and that hamper deployment of their ISCP.	Pohle and Chapman, 2006 ; Robson and Haigh, 2008.
Performance objectives	Expected and overall performance gains that the company hopes to achieve by this ISCP.	Rogers, 2003 ; Van Echtelt et al., 2008 ; Skipper et al., 2009.
Obtained performance	Overall gains and objectives realized following deployment of this ISCP.	Beamon, 1999 ; Panayides and Vénus Lun, 2010 ; Skipper et al., 2009.

The interview guide and its construction

The use of an interview guide (Table 4) is suitable given the exploratory nature of this research phase. We chose to conduct semi-structured interviews, in other words, let the interview progress naturally, while ensuring that during the course of the story being told, a number of predetermined topics be discussed.

Besides the introduction and conclusion, the guide contains two sections. The introduction describes the purpose of the research, discusses the confidentiality of the study and announces the program for the interviewee. In the conclusion, the respondent states his position and the characteristics of his company. The first part of the guide aims to clarify the concept of innovative supply chain practices. At the start of the interview, the respondent was asked to broadly define innovation, later this concept was refined in the context of inter-organizational practices and supply chain management. This work of establishing a definition helped us empirically understand, coming from the statements of professionals, the concept of innovation in supply chain management. The second part of the guide was dedicated to questioning the manager concerning one or two innovative supply chain practices in which he had participated during the past five years. The professionals were asked to identify and characterize, from their point of view, significant and representative inter-organizational practices. For each of these ISCPs, the respondent was asked to tell the "story" of the supply chain innovation being considered. For this, he was asked to specify who (or what event) was the source of the innovation, the degree of novelty (in comparison with existing inter-organizational practices in the company), its context of appearance, its challenges, motivations justifying its deployment, the different actors involved, the gains (expected and achieved), and the difficulties and obstacles encountered.

Generating items

The items should represent, in the most comprehensive manner possible, the constructs to be studied. According to MacKenzie et al. (2011, p. 304) "these items may come from a variety of sources (see Churchill, 1979; Haynes et al., 1995; Nunnally and Bernstein, 1994), including reviews of the literature, deduction from the theoretical definition of the construct, previous theoretical and empirical research on the focal construct, suggestions from experts in the field, interviews or focus group discussions with representatives of the population(s) to which the focal construct is expected to generalize, and an examination of other measures of the construct that already exist". In our research, we focused primarily on discussions and exchanges with professionals. The literature review was then used to complement and refine generation of the items.

At the end of the qualitative interview phase, the collected information was grouped by first order categories. These categories were formed by simple coding of the interviews. To generate statements for developing measurement scales, interviews were coded by performing a thematic content analysis. To check the validity of this coding, it was agreed that the first five interviews would be coded collectively by the researchers. This coding resulted in exchanges, discussions and working meetings which led to an encoding that was employed for the remainder of the interviews. There were frequent exchanges, and adjustments were made during the analysis.

Following the recommendations of Corley and Gioia (2004), thematic analysis of verbatim transcripts (representative quotations) identified the first order categories, which were then structured into second order themes. These themes were grouped into three aggregated dimensions that correspond to each of our three constructs. This data organization highlights hierarchical categories (verbatim => first order categories => second order themes => aggregated dimensions) from facts and observations (Gioia et al., 2013). The objective of this task was to define attributes that would be operationalized and measured by a set of variables. Tables showing the verbatim, the first order categories and

second order themes are presented in the appendix. A table was made for each construct (see appendix A for the construct "ISCP deployment conditions and context", appendix B for the construct "The organization's innovation capacity ", and appendix C for the construct "ISCP performance"). This analysis was used to generate an initial list of items.

Thanks to the rich quality of the interviews, several categories and themes emerged from the coding. Some categories mentioned by respondents were not chosen because they were considered to be: non-specific to the study (the development of new products with supplier involvement), too abstract (time as a factor in maturing experiences), too difficult to operationalize (SCM maturity, project budget in total euros), too specific to a service (the role of buyers) or a sector (the short life cycle of product technologies), too technical (information systems scheduling algorithms to support joint planning), or too small (a detailed management role).

Table 4. Qualitative interview guide

Introduction: Understanding the purpose of the research and the interview plan *Part 1: Definition of innovation and innovation in SCM:* 1 - How would you define the concept of innovation in general? Can you give an example? 2 - How would you define the concept of innovation in Supply Chain Management? Can you give an example? 3 - How would you define an innovative supply chain practice (ISCP)? Can you give an example? *Part 2: Discussion about an ISCP:* 1 - Why did you set it up? (reasons, motivations, challenges, expected gains) 2 - What is the source or origin of the innovation? - Who is at the origin? The company, its partner, something else? (what?). - Where is the origin? Local innovation (at the service site, company, subsidiary) or global (at the group level, the partner). 3 - Who are the key actors? - Who participates in this innovation process? The upstream or downstream partners, other types of stakeholders? How many people are affected by this innovation? - When are they involved? (Ask the respondent to specify the dynamics of the innovation) 4 - What kind of gains were realized? (financial, reputation, trust, ...). 5 - What are the obstacles? Financial, human, organizational, technological ... 6 - What does the innovation impact? Is it improving something or is it something new? What is the degree of generalization and / or dissemination of this innovation? 7 - What are the next two ISCPs your organization will deploy? *Part 3*: Presentation of the respondent, his company and his function: 1 - In what company and what business unit do you work? 2 - What is the size of the organization? 3 - What is the industry? 4 - What department do you work in? 5 - What is your position? *Part 4: Conclusion for the participation of the respondent*

To discuss the formulation and understanding of the questions, a first version of the items from previous phases was administered to five supply chain managers from industrial companies in the Rhône Alps region (a logistics manager, a director of operations, two supply chain managers, a supply chain planner). Their comments helped clarify certain items (an additional synonymous term was added in parentheses to characterize the two dimensions of the environment) and reformulate some questions (for example, those questions relating to knowledge creation were rewritten to be clearer and more understandable for the practitioners).

Following this qualitative phase, an initial version of the scales was created for the three constructs (Table 5). These scales were then tested statistically by a quantitative study (in an exploratory phase and a confirmatory phase).

Table 5. Initial version of the measurement instrument

Scales	Items
ISCP deployment conditions and context	We deploy ISCP mostly with: -Partners with whom we already have long-term relationships. -Partners with whom we collaborate regularly. -Partners who we trust. -Partners strategic for our business. -Partners with whom we have a lot of activities. -We deployed this ISCP to get results in the: -short-term (6 months to 1 year). -medium-term (1 year to 3 years). -long-term (more than 3 years). This ISCP was: -Imposed. -Voluntary. About our environment: -The environment in which we deployed the ISCP is turbulent (unstable). -The environment in which we deployed the ISCP is complex (difficult to understand, multi-faceted).
The organization's innovation capacity	About our attitude toward innovation: -We are accustomed to deploying ISCP. -We make many innovations to our products. -We make many innovations in our inter-organizational practices. -We are pleased with the performance of previously deployed ISCPs. -We innovate a lot. -We have structured tools and methodologies to support the deployment of an ISCP. The change management was a condition of the success / failure of the ISCP. -We had set up a joint organizational structure with your dedicated partner in the ISCP. -The establishment of an internal organizational structure dedicated to the ISCP was an important element in its success / failure. -The establishment of a joint organizational structure dedicated to the ISCP was an important element in its success / failure. -Change management was a condition for the success / failure of this ISCP.
ISCP performance	In our opinion, this ISCP is: -An organizational success. -A success at the supply chain level. Deploying this ISCP has allowed us to create: -Internal knowledge. -External knowledge with this partner. -External knowledge with the entire supply chain. This ISCP, once deployed, met our expectations in terms of: -Being within budget. -Timeliness. -Management satisfaction. -Customer Satisfaction. -Expected Earnings

THE QUANTITATIVE STUDY

In accordance with the requirements mentioned in the mobilized methodological researches (Churchill, 1979; Dunn et al., 1994; Hinkin, 1998; Hensley, 1999; MacKenzie et al., 2011), our scales were purified and validated with two independent samples (a control sample of 170 managers for purification,

and a final sample of 142 respondents for validation). We will present these two steps in this section, taking care to distinguish between the quantitative exploratory step (purification) and the quantitative confirmatory step (validation).

Surveys and samples

Following the methodology of construction and validation of a measurement scale, the measurement instrument was tested on two independent samples: one control sample (with 170 respondents) and a final sample (142 respondents). Details concerning information collection and the characteristics of the samples (the control sample and the final sample) are given in Table 6.

Table 6. Summary of data collection for the quantitative phases

	Exploratory	Confirmatory		Exploratory	Confirmatory
Collection date :	Nov. 2010 -April 2011	Nov. 2011 - January 2012	Activity sector	Percentage	Percentage
Type of collection : face-to-face questionnaire			Pharmaceutical	28 %	34 %
Number of respondents	170	142	Production and distribution of gas and electricity	14 %	10 %
Number of different companies	64	52	Microelectronic and electronic	11 %	12 %
Respondant function	Percentage	Percentage	Distribution	10 %	15 %
Supply Chain Manager	59 %	61 %	Automobile	9 %	11 %
Buyer/Supplier	14 %	11 %	Other (construction, agri-business, logistics provider…)	28 %	18 %
Head of production	14 %	9 %	Company size	Percentage	Percentage
Methods engineer	6 %	11 %	Greater than 1000 employees	44 %	35 %
Director	4 %	3 %	Between 251 and 999 employees	26 %	32 %
Commercial	3 %	5 %	Fewer than 250 employees	30 %	33 %

For both data collection phases, a questionnaire was constructed and administered face-to-face with our two samples. In order to test the measurement scales and facilitate analysis, we decided to use seven level Likert scales ranging from "do not agree at all " (1) to "strongly agree" (7) for all items. Respondents were asked to indicate their level of agreement or disagreement with a stated situation.

To ensure the quality of the respondents, we conducted a T test for independent samples (factorial invariance test) on each of our two samples (control sample and final sample). This test allowed us to confirm that there were no differences in responses between the "senior executive managers" (e.g. CEOs, presidents and vice-presidents) and "mid-level managers" (intermediate managers, such as directors and service managers), and that the perception of

the "mid-level managers" was as relevant as that of the "senior executive managers" concerning the phenomenon under study.

Purification conditions and validating scales during the quantitative and confirmatory exploratory phases

Factor analyses were performed using SPSS 20.0 software. First, we began by testing the feasibility of factor analysis by evaluating the KMO (Kaiser-Meyer-Olkin) adequacy and Bartlett's test of sphericity. We then conducted an analysis of the communities to check the explained proportion of variance recovered by the different factors. At this stage, we performed a refinement of the items that did not meet the following criteria: factorial score below 0.5, or too high on several factors, and isolated items (Roussel, 2005). We then determined the number of factors to be retained for each of our scales. Given the nature of our variables, the extraction method chosen was a principal component factor analysis. To retain the number of factors, we relied on two accepted criteria: the Kaiser Criterion (value > 1) and the Cattell Scree test (O'Connor, 2000). Finally, we checked the reliability of each factor to determine those to be chosen according to their Cronbach's alpha.

To check the stability and robustness of factor structures identified during the exploratory analysis phase, we conducted a confirmatory factor analysis (Dunn et al., 1994) using SPSS and AMOS. The purpose of the CFA was to identify and validate the link between an unobservable variable and the observed measurement variables that constitute it, and that via adjustment and testing of measurement reliability indices (Garver and Mentzer, 1999; Kline, 2011; Yu et al., 2013). From a statistical point of view, parameter estimation by maximum likelihood is based on the constraining assumption of respect for the multi-normality of variables. Indeed, CFAs normally require a minimum of 200 individuals. However, in the example of a rare population, as it is the case in our study, we used a bootstrap procedure (1000 replications).

The issue of choosing relevant indices arose (Sharma et al., 2005; Shah and Goldstein, 2006). However, the indices used in this research are commonly used (Byrne, 1989; Hair et al., 1995), especially in our disciplinary field (Zhu and Sarkis, 2004; Li et al., 2005; Zhu et al., 2005; Li et al., 2006; Zhu et al., 2008; Cao and Zhang, 2010, 2011). In the interest of scientific rigor, we chose different indices: GFI, CFI, NNFI (or TLI), SRMR, and RMSEA Chi² / dl. To check the fit of our measurement scales, it should also be noted that the value T (λ / standard deviation) is greater than | 1.96 | for each item. Finally, we estimated the psychometric quality of the measurement instruments using Jöreskog's Rhô as reliability index and the index of convergent validity (Fornell and Larcker, 1981; Chin, 1998).

RESULTS

We will present the results for all three scales (which together constitute our measurement instrument) using the following structure: convergent validity, discriminant validity and the existence of a latent factor (or "concept of second order").

RESULTS FOR THE SCALE "ISCP DEPLOYMENT CONDITIONS AND CONTEXT"

In a first iteration, the exploratory factor analysis revealed four factors that explain over 63% of the total variance for a KMO of 0.652 (Table 7). These factors are associated with the notion of partnership with 5 items, time for ROI

with 3 items, type of innovative process with 2 items and finally, the environment with 2 items. We note that the communities associated with the two environmental items do not meet the Roussel (2005) conditions with 0.412 for "the environment in which we deployed this ISCP is turbulent (unstable)" and 0.423 for "environmental in which we deployed this ISCP is complex (difficult to understand, multi-faceted)." These results can be explained by the fact that companies need to innovate regardless the characteristics of their environment. Despite an environment that is complex or turbulent, innovation remains a key source of value creation and competitiveness (Birkinshaw et al., 2008; Panayides and Venus Lun, 2010). For our sample, environmental pressures are not taken into consideration in their decisions to deploy an ISCP. Organizations need to go beyond environmental circumstances to incorporate other influences: initiatives from management (Goodale et al., 2011) or partners (Wynstra et al., 2010), desire for collaboration with partners (Zhao et al., 2008) or a quest for ROI (Lin et al., 2010).

By repeating the factor analysis without items relating to the environment, we find the other three initial factors with KMO of 0.654 and an explained variance of over 67%. These results are consistent with our literature review and all the factors related to the conditions and context of deployment are reliable with Cronbach's alpha coefficients of greater than 0.75.[1]

Table 7. Analysis for the scale "ISCP deployment conditions and context"

	Exploratory		Confirmatory				
Items	λ	Cronbach's Alpha	λ	Cronbach's Alpha	T Value	Jöreskog's Rhô	Convergent validy
Collaboration		0.801		0.813		0.842	0.525
Part1 - Partners with whom we already have long-term relationships.	0.787		0.552		8.80		
Part2 - Partners with whom we collaborate regularly.	0.801		0.528		10.40		
Part3 - Partners that we trust.	0.694		0.853		8.61		
Part4 - Partners strategic for our business.	0.721		0.811		5.08		
Part5 - Partners with whom we have a lot of activities.	0.715		0.810		6.73		
Expected gains (delay for recovery)		0.812		0.522		0.825	0.619
DIe1 - short-term (6 months to 1 year).	0.696		0.845		13.20		
DIe2 - medium-term (1 year to 3 years).	0.869		0.899		7.52		
DIe3 - long-term (more than 3 years).	0.854		0.579		14.05		
Innovative process		0.755		0.750		0.784	0.661
DIvi1 - Imposed**	0.771		0.568		3.16		
DIvi2 – Voluntary	0.852		1*		3.02		

GFI = 0.918 ; CFI = 0.914 ; NNFI = 0.876 ; SRMR = 0.0664 ; RMSEA = 0.086 ; Chi²/dl = 2.549

**Given the constraints of the AMOS software, it was necessary to reverse the item "[this ISCP approach was] imposed." The latter was recoded so that its meaning is consistent with that of the dimension.

The results of the confirmatory factor analysis applied to the total sample indicate good indices fit and a good measurement model affinity. Although the RMSEA and NNFI indices do not meet the threshold of validity (> 0.9 NNFI and <0.08 for RMSEA), they do, however, remain acceptable.

These results help defend the value of taking into account the three dimensions for the conditions and context of ISCP deployment. Each dimension is measured by at least two items, their respective reliability is proven by a Jöreskog's Rhô greater than 0.7 and a convergent validity greater than 0.5. All estimated parameters are thus statistically significant (T value> l 1.96 l).

We also tested the discriminant validity between the three dimensions of the concept "ISCP deployment conditions and context." This is satisfactory

1. In the case of development of a new measurement scale, a Cronbach's alpha is acceptable above 0.6 (Dunn et al., 1994; Nunnally and Bernstein, 1994; MacKenzie et al., 2011, p.A2).

because the differences (called Delta Chi²) between the free model Chi² and the constrained model Chi² all prove to be above 3.84 (Table 8).

Table 8. Discriminant validity for "ISCP deployment conditions and context"

	Chi²	Delta Chi² (ddl = 1)
Reference-free model	66.595	
Model constrained between "Collaboration" and "Expected gains"	71.046	Sig.
Model constrained between "Collaboration" and "Innovative process"	90.348	Sig.
Constrained model between "Expected gains" and "Innovative process"	96.082	Sig.

Finally, the existence of a latent factor "ISCP deployment conditions and context" consisting of three dimensions that were proposed, was validated. Indeed, order 2 modeling shows convergent validity (convergent validity: 0.516; Jöreskog's Rhô: 0.758) and satisfactory loading (collaboration: 0.689, expected gains 0.587; process: 0.854).

RESULTS FOR THE SCALE "THE ORGANIZATION'S INNOVATIVE CAPACITY"

Exploratory factor analysis reveals three dimensions that explain slightly more than 64% of the total variance for a KMO of 0.674 (Table 9). The first factor is related to the internal organizational structure responsible for the design and deployment of the ISCP. Of the three items that are grouped together, we retain only two. The item "we make many innovations to our products" with a community of 0.408, does not meet statistical validity constraints. This indicates that the fact that an organization realizes technical innovations in a broad sense (e.g. product innovation) has little influence on its ability to realize innovations in its practices. This means that an organization may have expertise in innovation of processes and / or practices with little technical experience in product innovation, as observed by Becheikh et al. (2006) who said "though it is true that a close link exists between product and process innovations, […] [they] follow different processes and do not necessarily have the same determinants" (Becheikh et al., 2006: 648).

The second factor includes all the items retained concerning the joint organizational structure between partners to design and deploy innovation. The third factor revolves around the concepts of experience and expertise in deploying an ISCP. By repeating the factor analysis without the relative item related to product innovation, we find the three initial factors with KMO of 0.683 and variance explained at roughly 68%. We also note that all the factors related to the innovative capacity of the organization are reliable, with Cronbach's alpha coefficients greater than 0.75.

Table 9. Analysis of the scale "The organization's innovative capacity"

	Exploratory		Confirmatory				
Items	λ	Cronbach's Alpha	λ	Cronbach's Alpha	T Value	Jöreskog's Rhô	Convergent validity
Internal structure		0.813		0.525		0.861	0.760
DIint1 - Change management was a condition for the success / failure of this ISCP.	0.907		1*		2.65		
DIint2 - The establishment of an internal organizational structure dedicated to the ISCP was an important element in its success / failure.	0.862		0.721		2.74		
Joint structure		0.914		0.951		0.940	0.886
DIext1 - The establishment of a joint organizational structure dedicated to the ISCP was an important element in its success / failure.	0.948		0.918		5.07		
DIext2 - You had set up a joint organizational structure with your dedicated partner in the ISCP.	0.931		0.964		4.07		
Experience and expertise		0.759		0.801		0.767	0.507
DIcap1 - We are accustomed to deploying ISCP.	0.772		0.747		12.45		
DIcap2 - We make many innovations in our inter-organizational practices.	0.807		0.802		14.58		
DIcap3 - We are pleased with the performance of the previously deployed ISCPs.	0.689		0.557		8.57		
DIcap4 - We innovate a lot.	0.681		0.513		6.58		
DIcap5 - We have structured tools and methodologies to support the deployment of an ISCP.	0.624		0.509		6.53		
GFI = 0.944 ; CFI = 0.958 ; NNFI = 0.956 ; SRMR = 0.0546 ; RMSEA = 0.076 ; Chi²/dl = 1.986							

The results of the confirmatory factor analysis indicate a good indices fit and a good measurement model affinity. These results help defend the value of taking into account the three dimensions for the innovative capacity of the organization. Each dimension is measured by at least two items, their respective reliability is proven by a Jöreskog's Rhô of greater than 0.7 and a convergent validity greater than 0.5. All estimated parameters are statistically significant (T> value l 1.96 l).

Additionally, Table 10 shows that the discriminant validity between the three dimensions of "The organization's innovative capacity" concept is satisfactory. Indeed, the differences (called Delta Chi²) between the free model Chi² and the constrained model Chi² are all greater than 3.84 (Table 10).

Table 10. Discriminant validity for "The organization's innovative capacity"

	Chi²	Delta Chi² (ddl = 1)
Reference-free model	46.731	
Model constrained between "Internal structure" and "Joint structure"	52.277	Sig.
Model constrained between "Internal structure" and "Experience and expertise"	59.836	Sig.
Model constrained between "Joint structure" and "Experience and expertise"	57.726	Sig.

Finally, the existence of a latent factor "The organization's innovative capacity" was validated. Indeed, order 2 modeling shows convergent validity (convergent validity: 0.529; Jöreskog's Rhô: 0.766) and satisfactory loading (internal structure: 0.846; joint structure: 0.713; experience and expertise: 0.602).

RESULTS FOR THE SCALE "ISCP PERFORMANCE"

We observe, in agreement with our literature review, that the scale on "ISCP performance" is organized using three dimensions that explain over 63% of the total variance for a KMO of 0.699 (Table 11) . The first factor is based on the extent of success and includes two items related to organizational success and success at the supply chain level. The second factor is related to the sharing of knowledge within an ISCP and brings together three items related to internal and external knowledge creation. The third factor is the match between expectations and results stemming from the ISCP. At this stage, we need to remove the item "The ISCP, once deployed, met our expectations in terms of compliance with deadlines" with a community of 0.436. This item was rejected because the concept of time potentially does not federate respondents due to a lack of clarity on this notion. In fact, the question referred to the management of deploying the ISCP (schedule compliance, for example), whereas the question could be interpreted as referring to respecting deadlines in terms of operational and logistical delays (for example "because of this ISCP, suppliers are now respecting their delivery deadlines" or "because of this ISCP our information transmission timing requirements are now being respected"). Interestingly, schedule compliance in the deployment of an ISCP is not always a priority. Deadlines can be variable and uncertain (Hoegl and Wagner, 2005) due to a number of limitations such as evolving project parameters and the integration of a potentially unstable partner in inter-organizational teams (Petersen et al., 2005; Brettel et al., 2011).

By repeating the factor analysis without the item related to timeliness, we find the three initial factors with KMO of 0.731 and an explained variance of over 67%. We also note that all the factors related to innovation performance are reliable, with Cronbach's alpha coefficients greater than 0.65.

Table 11. Analysis of the scale "ISCP performance"

	Exploratory		Confirmatory				
Items	λ	Cronbach's Alpha	λ	Cronbach's Alpha	T Value	Jöreskog's Rhô	Cnvergent validity
Scope of the success		0.799		0.899		0.807	0.678
PIre1 - An organizational success.	0.862		0.878		7.63		
PIre2 - A success at the supply chain level.	0.863		0.765		4.69		
Knowledge creation		0.764		0.561			0.508
PIK1 - PIK1 - Deploying the ISCP allowed us to create knowledge internally (new knowledge, information about our processes, problems, etc.).	0.860		0.582		7.76	0.753	
PIK2 - Deploying the ISCP allowed us to create knowledge externally with this partner (new knowledge, information about our processes, problems, etc.).	0.863		0.779		10.53		
PIK3 - Deploying the ISCP allowed us to create knowledge externally with the entire supply chain (acquisition of new knowledge, information about our processes, problems, etc.).	0.675		0.760		5.29		
Matching expectations		0.655		0.818		0.790	
PID1 - PID1 - The ISCP, once deployed, met our expectations in terms of budget compliance.	0.598		0.618		6.24		0.496
PID2 - PID2 - The ISCP, once deployed, met our expectations in terms of satisfaction of our management.	0.751		0.932		10.47		
PID3 - PID3 - The ISCP, once deployed, met our expectations in terms of customer satisfaction.	0.706		0.543		3.50		
PID4 - PID4 - The ISCP, once deployed, met our expectations in terms of expected gains.	0.699		0.663		6.24		

GFI = 0.941 ; CFI = 0.938 ; NNFI = 0.943 ; SRMR = 0.0797 ; RMSEA = 0.067 ; Khi²/dl = 2.047

The results of the confirmatory factor analysis indicated good indices fit and good measurement scale affinity. Note, however, that the convergent validity of the scale "matching expectations" is limited because it is slightly less than 0.5, but remains acceptable (Kline, 2011).

These results confirm the value of taking into account the three dimensions proposed to measure innovation performance. The reliability of the dimensions "extent of success" and "knowledge creation" are proved by a Jöreskog's Rhô greater than 0.7 and convergent validity of 0.5. All parameter estimates are statistically significant (T> value l 1.96 l). In addition, we can consider as acceptable reliability indices for the dimension "matching expectations" with a Jöreskog's Rhô at 0.790 and 0.496 for convergent validity.

We also tested the discriminant validity between the three dimensions of the "ISCP performance" concept. This is good because the differences (called Delta Chi²) between the free model Chi² and the constrained model Chi² are all greater than 3.84 (Table 12).

Table 12. Discriminant validity for "ISCP Performance"

	Chi²	Delta Chi² (ddl = 1)
Reference-free model	42.714	
Model constrained between "Scope of success" and "Matching expectations"	48.188	Sig.
Model constrained between "Scope of success" and "Knowledge creation"	76.708	Sig.
Model constrained between “Matching expectations" and "Knowledge creation"	85.38	Sig.

Finally, the modeling of order 2 shows convergent validity (convergent validity: 0.572; Jöreskog's Rhô: 0.796) and satisfactory loading (Extent of success: 0.711; Knowledge Creation: 0.616; Matching expectations: 0.912). This therefore validates the existence of a latent factor "ISCP perfomance".

CONTRIBUTIONS AND LIMITATIONS

CONTRIBUTIONS

From a managerial point of view, we have chosen to adopt a very broad definition of innovative supply chain practices. Therefore, our research focuses on all ISCPs without trying to differentiate them according to their characteristics (incremental / radical, upstream / internal / downstream, actors involved, etc.).

This research provides managers with an audit tool to identify and question the important organizational and inter-organizational dimensions when deploying an ISCP. Such a tool should enable them to identify the key factors for success (and failure), and thus design and implement strategies and actions to successfully implement ISCPs with their partners. From this perspective, the development of a capacity for organizational innovation (through an internal and a joint project structure and experience and expertise previously acquired), and the conditions and context of deployment, are critical to the performance of an ISCP, whether this practice is imposed (emergent) or voluntary (deliberate), and regardless of if the gains are short or long term, and independent of the type of collaboration.

From a theoretical perspective, our research focuses on managerial innovation practices in supply chain management, although few studies have focused on this subject (Arlbjørn et al., 2011). Indeed, most existing studies focus on product innovations, especially on design and product co-development with industrial partners, even though many studies show that practice innovation is a source of value creation (Birkinshaw et al., 2008).

From a methodological standpoint, our work can be seen as an advance because it provides a measurement instrument for innovative inter-organizational practices developed around three measurement scales. To ensure reliability and validity, we rigorously followed a methodological process recommended for this type of research (Churchill, 1979; Dunn et al., 1994; Hinkin, 1998; Hensley, 1999; MacKenzie et al., 2011).

The statistical results are satisfactory and demonstrate the interest of our measurement scales. Thanks to the development and validation of these three scales (which together constitute a measurement instrument for ISCP in SCM), we were able to use them to test and validate a conceptual research model (Lavastre et al., 2014). This chronological research design (create a measurement instrument and then use it to test a research model) is consistent with existing research practices. It thus opens the way to the development of future research in the field. This initial work should contribute to the development of research on managerial innovation in the SCM domain.

LIMITATIONS

This work proposes a measurement tools for innovative inter-organizational practices in the SCM field. From a managerial point of view, this measurement instrument consisting of three scales, is generic. Its content can be adapted or specified in terms of the types of ISCPs being undertaken, firm characteristics (size, industry), and the SCM context (maturity, degree of collaboration).

From a theoretical point of view, we have reduced the study of ISCP to a few variables. Other variables can be added as well. The theoretical factor "Characteristics of the Inter-Organizational Relationship (IOR)" with variables like risk sharing (Lettice et al., 2010), trust (Donney and Cannon, 1997), long-term orientation (Chen and Paulraj, 2004a), and information sharing (Li et al., 2005) did not emerge from our qualitative phase, although the review of the literature indicates the importance of these elements contingent to the relationship (Derrouiche et al., 2010). The factor "Environment" from the qualitative phase was not retained as an integral dimension after factor analysis. Similarly, the items related to the environment (we used complexity and turbulence) were not statistically grouped with those linked to the process (voluntary / imposed or deliberate / emergent). Damanpour (1996), however, stressed the importance of integrating environment-related variables such as uncertainty, complexity and variability. Moreover, Göktan and Miles (2011) suggested that a dynamic environment pushes companies to innovate. Empirically, this study only focuses on ISCPs in a French context, making generalization of our results to other countries difficult. From a methodological point of view, the relatively small size of our three samples (50, 170 and 142 respondents) should be taken into account. Our study focused on perceptions of those actors involved in the ISCP, not on objective and quantitative realities. This can create a response bias. In addition, we interviewed a single representative organization per ISCP, and this is a source of bias and inaccuracy (Li et al., 2005; Cao and Zhang, 2001). In addition, to study a phenomenon involving several organizations, it would obviously be preferable to question the members of the various organizations involved.

FUTURE RESEARCH AND CONCLUSION

In this article, we developed and validated three measurement scales that were already mobilized to validate a model (Lavastre et al., 2014)[2]. These scales provide insight into the contribution of ISCPs to supply chain performance and test many hypotheses from the literature. Our scales can also be enriched by introducing additional variables, such as characteristics of the organization (strategy, structure, organization) that deploys the ISCP, characteristics of its supply chain (supply chain length, upstream or downstream position of the organization), or the maturity of its SCM (McCormack et al., 2008). We can also test the hypothesis that there is an order to the deployment of inter-organizational practices, a "virtuous" path to innovation in terms of the maturity of the organization's supply chain management. This leads to examining whether having already developed an organizational innovation is a prerequisite for developing another innovation (e.g. a supplier Kanban or CPFR).

Several areas of research could enhance our overall understanding of ISCPs. A longitudinal study would build a dynamic representation, which could take into account the relationship between the developmental stage of the ISCP and its changing characteristics. It would capture the dynamics of the process (its evolution, the actors involved, challenges, and motivations) throughout its development. It would also allow us to observe variations in the intensity of ISCP characteristics over time. A qualitative study of an ISCP would provide a more complete picture of ISCPs, namely by performing in-depth interviews with the various partners involved in its deployment. An international study would also highlight specific cultural elements to assess their impact on ISCPs. Finally, a sector study of ISCPs could identify specificities by industry, activity or market structure. The first sector for study could be the automobile industry, known for its mature SCM practices in inter-organizational relationships (Wynstra et al., 2010). The second could be the retail sector which is very innovative in its relations between logistics partners, manufacturers and distributors (Oh et al., 2012).

2. This research design reflects the practices of the scientific domain. For example, Moore and Benbasat (1991) constructed in ISR (Information Systems Research) measurement scales and then validated a research model in 1996 (Moore and Benbasat, 1991; Moore and Benbasat, 1996); In the JOM (Journal of Management) Li et al. (2005) constructed scales that they later used to validate their research model in Omega (Li et al., 2006). Zhu and Sarkis (2004) followed the same process, building scales in the JOM (Journal of Management), validating the model in 2005 in the IJOPM (International Journal of Operations and Production Management) and then confirming their model in 2008 in the IJPE (International Journal of Production Economics) (Zhu and Sarkis, 2004; Zhu et al., 2005; Zhu et al., 2008). In 2010 in the IJPE (International Journal of Production Economics), Cao and Zhang developed a measurement scale on collaborative advantage in the SC (Cao and Zhang, 2010), thanks to which they validated their research model in 2011 the JOM (Journal of Management) (Cao and Zhang, 2011).

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APPENDIX A.STRUCTURE OF QUALITATIVE DATA FOR CONSTRUCT "ISCP DEPLOYMENT CONDITIONS AND CONTEXT" (WITH VERBATIM EXTRACTS)

Verbatim extracts	First order Category	Second order theme
The impetus came from the company's strategy. If our boss is not convinced, there's little chance that the supplier will go in our direction. To trigger this innovation, senior management had to want to share the strategy with the managers.	Required by the general management	Innovative process
We almost lost, in fact, because it is a change imposed by the supplier to improve their financial health. The suppliers imposed a change to their advantage and then we, we were forced to make it happen.	Required by the partner	
In flow management, yes, there has been a lot of innovations. Some were necessary, others were imposed. There are the factors of the Europeanization of clients, who become so big that their scope of influence extends beyond, outside the country's borders.	Balance of power	
This innovation, here, can create an innovation at the suppliers. It's here, I was the one who started the project!	Initiated by the customer	
For example, in agri-business, [...] it is not in a few months that we can change the nature of this relationship [customer-supplier] in our company. What was implemented and what will occur after several months, that's the practice of EDI, e-procurement that was launched in 2001, it's been eight years.	Evaluate long term ROI (Return On Investment)	Expected gains (time to recovery)
In this project, information reliability was the first expected gain; but after that comes efficiency, financial performance, etc. We cannot calculate a return on investment with this project. We cannot say I earn "that" through the deployment of this project.	Difficulty evaluating the ROI	
This change in the organization of physical flows should allow us to achieve short-term gains and regain power over our suppliers. Mainly to save on [...] operating costs, plus, more reliability since with consignment stock, we are closer and quicker. So we're more reactive when problems arise.	Improve short term reactivity	
With these new workflow methods, we want to reduce inventory in the factory, to make more money. With this approach, we can reduce our preparation costs, optimize the preparation mix. The key is logistics costs.	Reduce costs	
This is an inter-organizational innovative concept in the sense that they are no longer a mere supplier, but also the brainpower, the innovations ... It's a true collaborative work. Other buyers focus on price, but ours have our corporate culture and respect for their partner.	Lack of cooperation with the partner	Collaboration
I expect that with this project we will lose less time communicating with this supplier, less time searching for data, there will be more automation. We improved our lag time between the two plants and between the upstream and downstream actors at the two plants, because we really introduced a work method based on trust, teamwork, allowing us to maximize flow security.	Secure and track exchanges with partner	
To have an interesting business case, it has to cost less for the supplier, so they revise their operations. The innovation was established because of constraints due to stock. It's an immobilized financial asset. To address this financial constraint, consignment stock appeared to be a way to make the supplier bear the burden of the stock.	Partner's financial capacity	
You've got to find companies that have the same power over their suppliers, who have a lot of flow and diversity. Some providers have more weight than others, but we can't change that.	Risk of dependence and opportunism	
But we are already doing this with some suppliers, so the change will be less brutal. For the moment, we've integrated one car bodybuilder into the project, because it's the only one that really does large volumes for us. But it's important to us, and we hope we can do the same with other suppliers, even though we know it's not easy.	Actor implicated	

APPENDIX A. STRUCTURE OF QUALITATIVE DATA FOR CONSTRUCT "ISCP DEPLOYMENT CONDITIONS AND CONTEXT" (WITH VERBATIM EXTRACTS)

Shortening product life cycle	First order category	Second order theme
The trend is simply that the work environment has changed. Ten years ago, we made a product for several years. Now, we must constantly innovate to be trendy. Thirty percent of our products are updated annually.	Shortening product life cycle	Environnement
Rather, it is linked with requirements of customers, who express their needs as late as possible, so it can be as rapid as 48 hours, whereas before it could have been [...] 2 weeks or 1 month. The problem was to handle the outstanding orders, international "demand review", and better serve the customer.	Customer demand difficult to predict	
Our partners are impacted by this innovation. Finally, we're all in the same boat: us, our suppliers, and our logistics providers. It's all about the customer. The supplier is obliged to maintain its database to produce and transport, so we will extend it to the customers [...] So we are synchronised right up to the distributor.	Problem of an extended enterprise	
With the arrival of Chinese companies in our market, we are forced to be alert, and be able to react super-fast. Our design department and our marketing department are accustomed to working together, but with suppliers it's harder.	Frequent technological changes	
First, we were hit by the crisis affecting all automotive industries. In order to free-up cash flow [...] we have to drastically reduce our inventory with our suppliers. The staff was interested in this project because it allowed us to address these aspects linked to the economic crisis.	Economic crisis	

APPENDIX B. STRUCTURE OF QUALITATIVE DATA FOR CONSTRUCT "THE ORGANIZATION'S INNOVATIVE CAPACITY" (WITH VERBATIM EXTRACTS)

Verbatim extracts	First order Category	Second order theme
The staff totally supported the project. This is the first project at X had a real organizational dimension, [a] process with strong senior management and end user involvement [...].	Employee implication	Internal project structure
The design office is very knowledgeable about the products, but concerning collaborative processes, that's another story. When we opened our ERP with X [our supplier], we had to educate our employees.	Staff training	
Change management, it's always the same problem! The biggest challenge was resistance to change because each of the two plants defended its interests.	Change management	
After launching the project, we formed the project team: the buyer [...]; the transportation service [...]; the IT service [...]; management control [...]; logistical methods [...]. Our methodology is imposed by the group, we use the management methodology from project X with milestones / deliverables that are approved by a logistics steering committee (that includes management).	Project management	
Buyers act alone, they do not listen! Before, the three actors, the logistician, the technical manager and the purchaser worked separately. Each had clearly defined goals, but they were disproportionate to each other. Everyone did solo negotiations.	Lack of communication	
Our project team consisted of purchasing and representatives from all the processes: management control, logistics, IT [information technology], local purchasing. Internally, the actors involved were the industrial logistics management, the logistics managers at each plant, the factory managers, and the head of manufacturing.	Types of internal actors implicated	
Currently, we're all here, together we have lots of ideas. Information resources are essential: it increases communication with our (automotive) bodybuilders.	Communication between partners	Joint project structure
The supplier came to our site two or three times with one buyer and two logistics technicians, to set up procedures and the needed IS [Information Systems], and now we audit it annually. It involves our integrated bodybuilders who are responsible for the quality control of our vehicles [...] This requires a lot of confidence in our partner.	Active supplier participation	
At first, we went without a project structure [...]. To succeed with the innovation, we set up an organized project structure with the supplier, with a multi-site team [...]. So that means: my boss [...], me, the upstream logistics manager, two people from the local market, [...] and the supplier that will make two people available for the project.	Project management	
Our buyer found a good price, but the supplier doesn't have the same issues as us. [During the first meeting] around the table, you could hear a pin drop, we were wondering what we were doing there. It took us four months to get comfortable.	Lack of communication	
There are more than 100 actors, internally and externally (suppliers) [...], involved in this project. It also allows us to work in partnership with the distributors, to pursue other things tomorrow. Yes, we have a project [...] CPFR (Collaborative Planning Forecasting and Replenishment). The idea is to be able to increase the frequency of delivery to distributors.	Types of external actors implicated	
To be effective from the start, you have to ask the question of how the project will unfold. At X, we begin by benchmarking, we are still benchmarking in the area of trucks, but even in other areas, there may be good ideas that can be used.	Change management	Experience and expertise
The supplier is very far, he speaks English poorly, and with the time difference, we can say that it's difficult. Yes, culture can be a challenge, this is particularly the case with Germany [...]. The CEO of the country is often involved because this innovation spans multiple businesses and we need a common approach by country.	Intercultural dimension	
We went to people who had experiences with other manufacturers. We have a corporate methodology that has to be followed for all projects: there are several gates [milestones] presented and approved, or not, by the committee throughout the projects' progress. We took advantage of the expertise of X to extend [the Vendor Managed Inventory] in Y, it was set up in late 2009.	Work methods	

APPENDIX C. STRUCTURE OF QUALITATIVE DATA FOR CONSTRUCT "ISCP PERFORMANCE" (WITH VERBATIM EXTRACTS)

Verbatim extracts	First order Category	Second order theme
The gain thanks to an open SAP is that everyone has the same information, and it can be accessed by everyone. I mean, if the innovation is compartmentalized and limited to a small area, it loses its power and we lose some of the potential benefits.	Improved collaboration	Extent of success
The innovation focused mostly on the upstream flow, since it changes the relationship between us and the purchasing company. Our transportation providers are also impacted by this innovation to the extent that for them to be selected, they must prove that they have the same level of quality and safety.	Better internal and external flow management	
The leadership is critical because this innovation is there to diminish work related accidents, the real risks. In addition, the supplier must maintain a certain reference quantity in stock (minimum and maximum stock). The risks and costs associated with this stock are borne by our supplier.	Risk sharing	
The innovation is primarily related to the internal preparation process for X, insofar as one preparation method had advantages in terms of productivity. Faced with the economic crisis [...], innovation and responsiveness have become the strength of the supply chain; 15 or 20 years ago, the contrary was true, back then quality was the issue.	Productivity, quality, lead time, responsiveness	
.This allows the supplier to better anticipate their work and we need to know when the product will be complete and available. And it avoids over stocking. The aim is to reduce the provisioning time for products, it reduces most of our costs: transportation, customs fees, labour costs.	Reduced costs	
Rigor will have an impact on the product quality. IFS [International Food Standards] standards can reinforce brand image and show the effort that was made to certify all the sites. We put it in place to ensure a quality process in line with customer expectations, pharmaceutical companies, get closer to an image that is more like a laboratory.	Reputation, image and confidence with respect to partners	
Thanks to it, we see that the customer is increasingly integrated and present throughout the processing of their order, this increases our level of service. It all started with customers who were dissatisfied due to delivery delays, stock outs. Project X was designed to solve the problems with these customers	Improved customer service levels	
When we can effectively manage the cross-functionality, we can more fully exploit the innovation and reap the largest benefits. Today, innovation is a pillar for many companies that they build their competitive advantage on. But innovation is no longer individual, it's part of a collective and collaborative approach with all stakeholders in the supply chain.	Competitive advantage	
Our relationship between X and Y already existed, but the fact of establishing this innovation has helped structure the relationship. The table is being used to train people who work in the store and train them to the Kanban culture.	Standardized information quality	Knowledge creation
We defined the concepts, parameters, and goals, ensuring that everybody understood the project. Then, there is the development part that will involve the participants and those who have the knowledge to develop tools and ideas.	Knowledge sharing	
Our boss and our legal team warned us that the suppliers might get the forecasts from our customers. Our distributor is reluctant to give us too much information about their customers.	Secure and track interactions	
Our logistics manager spent two days at our client to understand their processes so we can then adapt to them. This is to optimize the operation between the business units, the business units will develop parallel solutions.	Specific developments	
It's true, that it helps integrate our supplier a bit more thanks to our information system. In addition, we will share a lot of data. That requires computer skills, knowledge of all the IS that exists in our field.	Information system limits	
It's not enough to innovate so that only some of the actors benefit, this innovation needs to be disseminated. They need to appropriate the change so that there is continuity in the use of this innovation, which is not always obvious.	Actors implicated	

APPENDIX C. STRUCTURE OF QUALITATIVE DATA FOR CONSTRUCT "ISCP PERFORMANCE" (WITH VERBATIM EXTRACTS)

Verbatim extracts	First order Category	Second order theme
The potential gains are accurately quantified with Cost Deployment. When deploying this solution, our senior manager required us not to go over budget.	Budget control	Matching expectations
For X, this certification emerged as a goal for improving quality to better satisfy our customer. It helped create a climate of confidence [...]. We provide guarantees to our customers, thus increasing their satisfaction. This allowed optimizing customer satisfaction by optimized shipping in terms of trucks and frequency [...].	Client satisfaction	
And there is the problem. Because it is always difficult to assess in advance the gains that we will be able to obtain with a VMI. What saved us afterward is that we immediately succeeded (from an operational point of view) to move the numbers in the right direction.	Poor estimation	
This innovation came from the management since it was a strategic orientation applicable to all the geographic areas of the group. The results met their expectations. This innovation came from the purchasing department and was supported by the supply chain management and the site management: the gains were larger than expected.	Satisfaction of the management of the organization	
It's for cost reasons that this innovation was approved: according to a statistical study, some providers do not always deliver the desired quantity at the requested time. So the only way to do that is to say, "OK, I'll reduce my order mix a little, but will work with 3 or 4 other manufacturers to deliver every day or every other day."	Better collaboration	
And also, in terms of payment to suppliers, we had late payments and so it helped to have a strong traceability of electronic orders, and invoices. Yes, better visibility and better control. It is a tool that allows us to better manage inventory and better manage supplies and stops. Suppliers can be warned in advance.	Improve data reliability	
Avoid overstocking, which existed to cover different fluctuations in demand for our end customers and, therefore limit (to the greatest extent possible) production and supply variations. Mainly to save money, to reduce operating costs, plus, to have more reliability with consignment stock, it's closer, more rapid. So we're more reactive when problems arise, in the event of shortages, quality problems, or if it's necessary to reorder.	Improve responsiveness to variation in demand	
Collaborative practices throughout the supply chain to convey and share information allow us to increase sales by including cash payments. This project helped increase sales because demand was more predictable, the client managed to better understand their needs and to better inform X.	Develop sales	
We're presenting new recommendations internally and with the procurement personnel and suppliers to continue to do just as well in terms of adequate activity. Normally, we ask suppliers to have their own consignment stock near our plants to create a small loop between plant X and the supplier's plant, that's pretty close to the consignment stock.	Improve service quality	
The ultimate goal of this innovation is to have an impact on the company results in terms of customer satisfaction and cost reduction. We gain in stock value and storage space. For the Ex-works delivery, the motivation is essentially financial, in terms of the potential savings.	Reduce costs	

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